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SERIES 3, Vol. 25, No. 5 MAY, 1942

# AMERICAN JOURNAL OF OPHTHALMOLOGY

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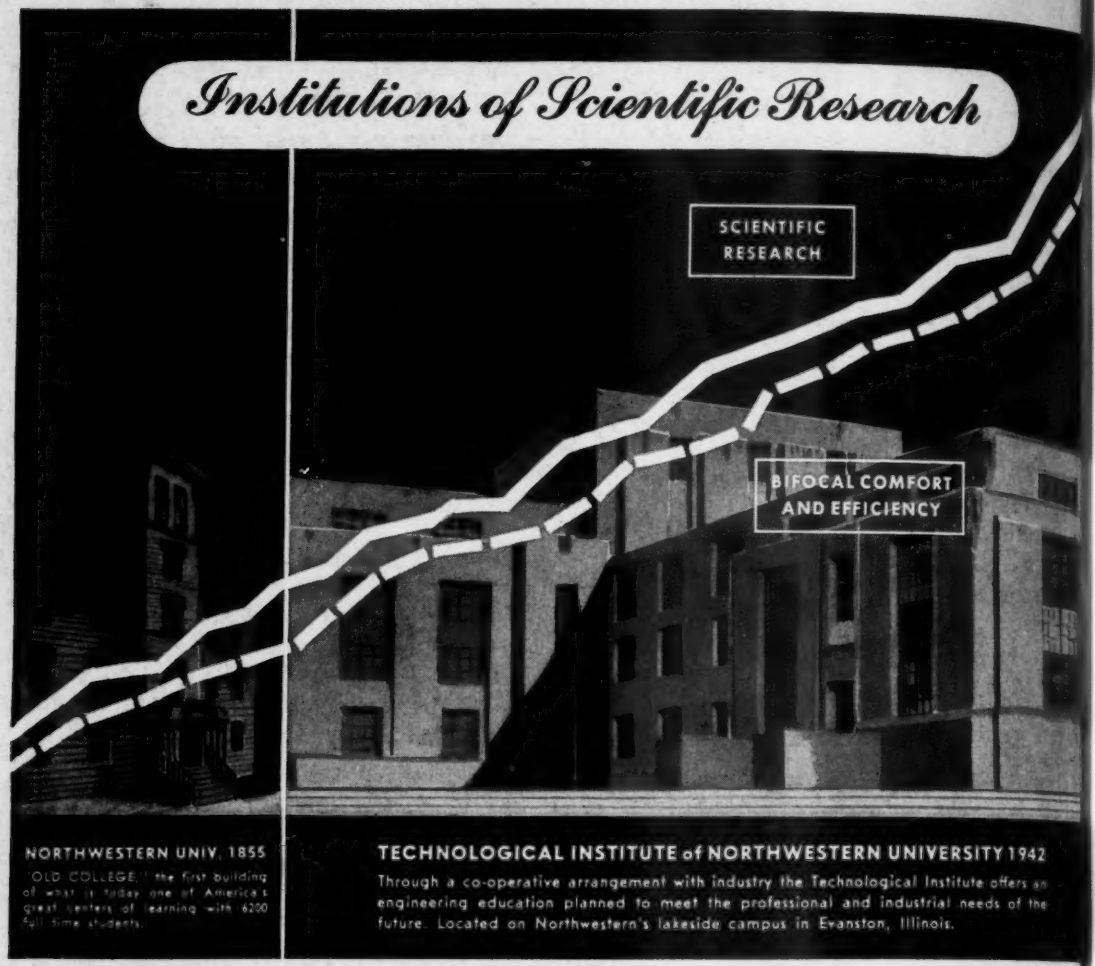
*Subscription price in United States ten dollars yearly. In Canada and foreign countries twelve dollars.* Published monthly by the George Banta Publishing Company, 450 Ahnaip Street, Menasha, Wisconsin, for the Ophthalmic Publishing Company. Subscription and Editorial Office: 837 Carew Tower, Cincinnati, Ohio. Entered as second class matter at the post office at Menasha, Wisconsin.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AMERICAN JOURNAL OF OPHTHALMOLOGY

VOLUME 25 MAY, 1942 NUMBER 5

# LIPEMIA RETINALIS*

S. H. McKEE, M.D., D. R. WILSON, M.D., A. F. FOWLER, M.D., AND MISS B. WILEN

*Montreal, Canada*

Lipemia retinalis is the term applied to an exceedingly characteristic ophthalmoscopic picture that occurs in certain cases of lipemia. This was first described by Heyl[1,2] in 1880. The condition is comparatively rare and there are only about 60 cases reported in the literature.[3,4,5,6,7] Of these cases, 24 were reported before insulin was available in 1922. In a previous publication from this hospital, in 1931, McKee and Rabinowitch[8] reported the forty-second case in the literature. Since this review, 17 additional cases have been reported. We believe that the case here presented is the sixtieth to be recorded.

## CASE REPORT

F. F., a white male, aged 23 years, was admitted to The Montreal General Hospital on February 20, 1941.

On admission he complained of increased thirst, polyuria, polyphagia, and weakness, associated with loss of weight for the past five months. He also stated that, for the past six weeks, he had noticed small raised nodules over both elbows and knees. His past history was irrelevant and there was no family history of diabetes mellitus.

The history of the present illness revealed that the patient was last perfectly well five months prior to admission. He first noticed that his fluid intake increased and that he was passing increasing amounts of urine. Paralleling the thirst, his appetite increased, but in spite of this, he noticed a loss of 25 pounds in weight and increased weakness. He consulted his physician at this time, and a diagnosis of diabetes was made. A diet was recommended which, however, the patient did not follow. Two months later, he developed an ischiorectal abscess. He was admitted to a hospital in his home town and the abscess was incised. At this time he received insulin, but apparently only three injections were given. The wound is reported to have healed at a satisfactory rate. Since the operation he has continued as formerly, eating a full unrestricted diet. Approximately six weeks prior to admission, he noticed the appearance of hard raised nodules on his knees and elbows. The patient continued a downhill course, the signs and symptoms of active diabetes increased, and he was referred to this clinic.

On admission, physical examination revealed a well-developed, poorly nourished young man with the following conditions: (a) acidosis, (b) multiple xanthomata over both elbows and knees, (c) lipemia retinalis. Apart from these, the physical examination was negative.

The blood pressure was 100 mm. Hg. systolic and 60 mm. Hg diastolic.

*From the Department of Ophthalmology and the Department of Metabolism, The Montreal General Hospital.

TABLE 1

SHOWING RELATIONSHIP BETWEEN THE PLASMA LIPIDS AND THE CLINICAL OBSERVATIONS ON THE APPEARANCE OF THE FUNDI

| Day | Plasma Lipids mg. per 100 c.c. | | | | | Remarks |
|---|---|---|---|---|---|---|
| | Total Lipids | Total Chol. | Neutral Fat | Phospho-Lipids | Total Fatty Acids | |
| 1 | 8,439 | 704 | 6,058 | 1,427 | 6,947 | Admitted. Diagnosis: Diabetes, lipemia retinalis, acidosis, multiple xanthomata |
| 2 | 6,796 | 712 | 4,471 | 1,333 | 5,407 | A very beautiful case of lipemia retinalis. Note the ribbonlike white vessels, especially toward the periphery, as if milk has replaced the blood |
| 3 | 5,238 | 749 | 3,940 | 733 | 4,543 | Fundi now appear pinker than yesterday, with vessels losing their milky appearance, especially in the temporal veins—now normal for four disc diameters from disc |
| 4 | 4,374 | 697 | 2,763 | 633 | 3,324 | Milky-white appearance of vessels receding farther from disc—now normal to six disc diameters. The vessel walls themselves seem to retain the lipid material longest with the central lumen assuming a purplish hue as recovery progresses |
| 5 | 3,358 | 697 | 1,817 | 553 | 2,382 | Condition definitely less than it was, although vessels in periphery still show the lipemia |
| 6 | 3,467 | 712 | 1,984 | 447 | 2,504 | Patient's retinal vessels fast approaching normal. The ribbonlike effect has gone, and the milky appearance is seen only in the very periphery |
| 7 | 2,751 | 670 | 1,279 | 487 | 1,850 | Vessels normal except for tiny white haze in the peripheral part of two or three vessels. |
| 8 | 3,024 | 557 | 1,840 | 320 | 2,216 | Vessels and fundi in general normal. In one area (left temporal side) there was some slight white haze to the vessel |
| 9 | 2,276 | 497 | 1,324 | 247 | 1,629 | |
| 10 | 2,142 | 531 | 1,095 | 273 | 1,463 | |
| 11 | 1,636 | 377 | 851 | 253 | 1,130 | Patient has been examined from day to day, and fundi found normal since the eighth day. Seen again today—vessels, and others, quite normal |

Urinalysis (admission):

Sugar .....4.1 percent
Sodium-nitroprusside reaction ....+
Ferric-chloride reaction .....+

Blood studies obtained on admission (three hours after a meal) disclosed the following findings:

Sugar (non-fasting) .....0.500 percent
Total lipids .....8.439 percent
Total cholesterol .....0.704 percent

The blood was obviously lipemic and the plasma appeared creamy. The following morning a fasting specimen of blood revealed:

Sugar (fasting) .....0.285 percent
Urea nitrogen .....13 mg. per 100 c.c.
Creatinine .....2.04 mg. per 100 c.c.
Calcium .....6.3 mg. per 100 c.c.
Phosphorus .....2.22 mg. per 100 c.c.
van den Bergh .....0.2 units
Carotin .....0.472 mg. percent
$CO_2$ .....36 vols. percent

Hematologic studies showed a count of:

R.B.C. .....3,820,000
W.B.C. ..... 7,100

The hemoglobin content was not recorded, owing to the fact that the lipemia interfered with the color matching of the hemoglobin estimation.

*Examination of the fundi* revealed the presence of a lipemia retinalis. The fundi were alike. Each retina showed the optic disc to be of normal color; the vessels on the disc, and for the width of the disc away from it, seemed quite normal. At about this point, however, they merged into white lines that appeared to be flat-

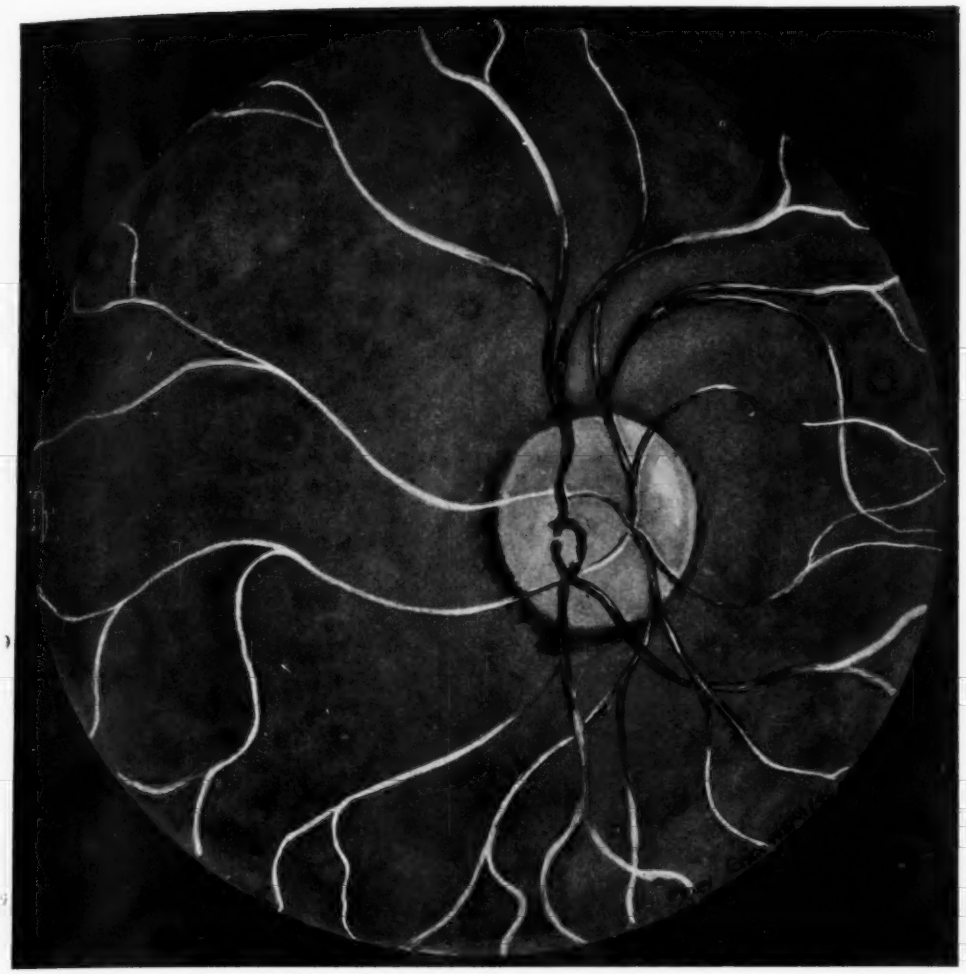

Fig. 1 (McKee *et al.*). Ophthalmoscopic view of fundus in a case of lipemia retinalis.

tened. The milk-white appearance became more marked towards the periphery, where any differentiation between arteries and veins was impossible. The small vessels became white much nearer the disc than did the larger ones. Also the veins on and near the disc had a very definite purplish color. Apart from these vessel changes, the fundi were quite normal (fig. 1).

The acuity of vision in cases of lipemia retinalis has been questioned. In the first case reported by Heyl, the patient was a male, 20 years of age, with "dimness of sight." In view of this, particular attention was paid to testing the vision of our patient, and the acuity of vision was found to be quite normal in each eye.

The fundi were examined daily. In table 1, the observations on the examination of the fundi are recorded and this table also shows the relationship to the levels of the various lipid fractions. It will be observed that the appearance of the fundi changed perceptibly after the third day of observation. Examination on

the fourth day revealed that the milky white appearance of the vessels was definitely receding from the disc. The vessel walls themselves seemed to retain the lipid material longest, with the central lumen assuming a purplish hue as recovery progressed. On the sixth day, it was noticed that the retinal vessels were fast approaching a normal appearance. The ribbonlike effect had disappeared, and the milky appearance was noticed only in the extreme periphery. On the eighth day, the vessels and fundi in general were reported as being normal. Examination daily for the next three days revealed that the fundi were normal and that the acuity of vision in each eye was also normal. The detailed descriptions of the appearance of the fundi, as outlined in table 1, are of interest, especially as they record the various changes that took place from day to day. It will be noted that the changes in the periphery were the last to disappear. In this regard, it is of interest to compare these findings with the observations reported by Moore,[9] who records watching the gradual evolution of lipemia retinalis, in the course of six weeks, in a man who was known to have lipemia. The first indication was a milky or hazy appearance of the retinal vessels towards the periphery, their color otherwise remaining normal; slowly this milkiness became more pronounced and the color became cherry red. The arteries and veins approximated each other in appearance, until ultimately the fully developed picture occurred shortly before death. The changes recorded in the periphery are of special interest. In Moore's case, these were the first to appear and in our case they were the last to disappear.

The appearance of the fundi in lipemia retinalis is pathognomonic and cannot be confused with any other ophthalmoscopic picture. The changes are entirely limited to the retinal vessels and the following pertinent factors should be noted:

*Color of blood vessels.* The color has been described in a number of ways such as light salmon, strawberry and cream, milky, light pink milk, and, at times, as having a silvery sheen or glow.

*Size and shape of blood vessels.* This is a characteristic picture—the vessels appear to be about twice their normal caliber. In advanced cases, the vessels may be flat and ribbonlike in appearance.

*Differentiation between arteries and veins.* The small arteries and veins are practically indistinguishable from each other. Some differentiation can be noted in the larger vessels, although in advanced cases this is, at times, difficult.

*Character of the "light streak."* This may vary considerably. The "light streak" may be entirely absent or of unusual breadth.

Although there are a number of descriptions of this condition, little of an essential nature has been added to Heyl's original observations. . . . "The moment my eye caught the details of the fundus, I saw the remarkable appearance which I shall endeavour to describe. The appearance was the same in each eye. . . . The fundus was free from any evidence of the existence or pre-existence of inflammation; the nerve-margin was well defined, the vessels were not tortuous; no retinal lesion, and no hemorrhagic clots were seen. The abnormal appearances which attracted attention were: the abnormal colour of the blood in retinal vessels . . . and the apparently large diameter of the vessels; the vessels appeared to have about twice the normal calibre. . . ."

*Treatment of diabetes.* The patient was placed on a high-carbohydrate low-calorie diet and this was gradually increased by the ladder method, his final diet being 254 grams of carbohydrate, 42 grams of fat, and 105 grams of protein. He was also

given protamine zinc insulin, and in order to obtain satisfactory control of the diabetes, it was found necessary to administer 40 units once daily before breakfast. In table 2, the details of the control of the diabetes are correlated with the total plasma lipids and the total cholesterol.

## Discussion

Lipemia is a condition in which the fat present in the blood is emulsified to such a degree, or in such a state, as to cause an alteration in the appearance of the blood. It occurs in a variety of conditions, such as diabetes, pneumonia, peritonitis, alcoholism, phosphorus poisoning, asphyxia, starvation, trench nephritis, pregnancy, carcinoma, and tuberculosis. With two exceptions, diabetes is the only disease wherein the condition becomes sufficiently marked to be seen ophthalmoscopically. One exception is a case of leukemia that had undergone radiation treatment,[10] and the other is a case, recorded as occurring in a poorly nourished child, aged one year. In this case there was an associated xanthomatosis and enlargement of the liver and spleen.[6] In the cases occurring in diabetes, practically every one has been associated with acidosis. Usually the acidosis has been severe and of short duration, as in the case previously reported from this clinic.[8] In the case here reported, however, the acidosis was comparatively mild but would appear to have extended over a considerable length of time. There are, therefore, probably two factors to consider: first, the severity, and second, the duration of the acidosis. In some of the cases recorded, xanthomata have been reported as an associated condition. In the case here reported there were multiple xanthomata over both elbows and knees. Figure 2 shows the appearance of the nodules over one elbow.

Lipemia retinalis, as the name implies, is associated with excess quantities of fat in the blood. Reis[11] reported the first quantitative analysis of the blood fat in this condition, in 1903. Analyses have been recorded in most of the cases, but the reports deal only with the total lipids of

TABLE 2

Showing relationship between level of fasting blood sugar, diet, insulin dosage and the plasma lipids

| Day | Blood Sugar percent | Diet | | | Insulin P.Z.I.† units | Plasma Lipids mg. per 100 c.c. | |
|---|---|---|---|---|---|---|---|
| | | COH | Fat | Prot. | | Total Lipids | Total Cholesterol |
| 1 | 0.500* | | Broth | | | 8,439 | 704 |
| 2 | 0.285 | 56 | 42 | 72 | 20 | 6,796 | 712 |
| 3 | 0.263 | 74 | 42 | 75 | 20 | 5,238 | 749 |
| 4 | 0.200 | 92 | 42 | 78 | 20 | 4,374 | 697 |
| 5 | 0.181 | 110 | 42 | 81 | 20 | 3,358 | 697 |
| 6 | 0.192 | 128 | 42 | 84 | 20 | 3,467 | 712 |
| 7 | 0.232 | 146 | 42 | 87 | 30 | 2,751 | 670 |
| 8 | 0.181 | 164 | 42 | 87 | 30 | 3,024 | 557 |
| 9 | 0.145 | 182 | 42 | 93 | 40 | 2,276 | 497 |
| 10 | 0.107 | 200 | 42 | 96 | 40 | 2,142 | 531 |
| 11 | 0.107 | 218 | 42 | 99 | 40 | 1,636 | 377 |
| 12 | 0.095 | 236 | 42 | 102 | 40 | 2,029 | 367 |
| 13 | 0.085 | 254 | 42 | 105 | 40 | 1,433 | 316 |
| 14 | | 254 | 42 | 105 | 40 | 1,162 | 301 |
| 15 | 0.071 | 254 | 42 | 105 | 40 | 1,037 | 298 |

* Admission specimen—non-fasting.
† Protamine zinc insulin.

the blood. In only a few instances are there reports of detailed studies of the various fractions of the blood lipids.[4] Attempts have been made to establish a level

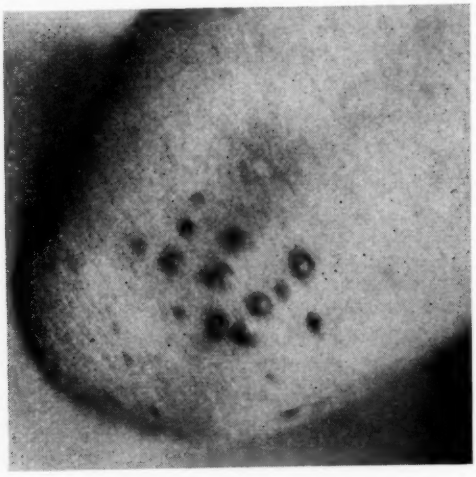

Fig. 2 (McKee *et al.*). Showing the appearance of xanthomata about the elbow.

of total blood fat at which lipemia retinalis may appear and also a level below which the condition disappears. No definite level has been established, and there would appear to be considerable individual variations. For example, in the case reported by Jaffe and Schonfeld[3] the fundi were normal when the total blood lipids had fallen to 16.3 percent. This is in marked contrast to the case previously reported from this Hospital by McKee and Rabinowitch,[8] in which the fundi were not perfectly normal when the blood fat had decreased to 1.13 percent, but were normal the following day when the blood fat was 0.84 percent.

The case reported by Lepard,[12] in which total blood-fat estimations were made over a period of about three months, revealed that lipemia retinalis was observed when the blood fats increased to approximately 4.250 percent and disappeared when the blood fats were reduced to approximately 2.8 percent. In the case here reported, the retinas were practically normal when the total lipids had reached 2.751 percent. In the case reported by McCann,[13] lipemia retinalis was observed when the blood fat was 9.5 percent, but the condition was not present when the blood fat had increased to 10.8 percent. It

TABLE 3

SHOWING THE RESULTS OF THE ANALYSES OF THE VARIOUS COMPONENTS OF THE PLASMA LIPIDS (REPORTED IN MG. PER 100 C.C. PLASMA)

| Day | Total Lipids | Fatty Acids | | | | Neutral Fat | Phospho-Lipids | Cholesterol | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Total Fatty Acids | Ester Chol. Fatty Acids | Phospho-Lipid Fatty Acids | Neutral Fat Fatty Acids | | | Total | Free | Ester |
| 1 | 8,439 | 6,947 | 250 | 942 | 5,755 | 6,058 | 1,427 | 704 | 331 | 373 |
| 2 | 6,794 | 5,407 | 280 | 880 | 4,247 | 4,471 | 1,333 | 712 | 294 | 418 |
| 3 | 5,238 | 4,543 | 316 | 484 | 3,743 | 3,940 | 733 | 749 | 277 | 472 |
| 4 | 4,374 | 3,324 | 281 | 418 | 2,625 | 2,763 | 633 | 697 | 277 | 420 |
| 5 | 3,358 | 2,382 | 291 | 365 | 1,726 | 1,817 | 553 | 697 | 262 | 435 |
| 6 | 3,467 | 2,504 | 324 | 295 | 1,885 | 1,984 | 447 | 712 | 229 | 483 |
| 7 | 2,751 | 1,850 | 315 | 321 | 1,214 | 1,279 | 487 | 670 | 200 | 470 |
| 8 | 3,024 | 2,216 | 257 | 211 | 1,748 | 1,840 | 320 | 557 | 173 | 384 |
| 9 | 2,276 | 1,629 | 208 | 163 | 1,258 | 1,324 | 247 | 497 | 187 | 310 |
| 10 | 2,142 | 1,463 | 243 | 180 | 1,040 | 1,095 | 273 | 531 | 168 | 363 |
| 11 | 1,636 | 1,130 | 155 | 167 | 808 | 851 | 253 | 377 | 145 | 232 |
| 12 | 2,029 | 1,496 | 153 | 207 | 1,136 | 1,196 | 313 | 367 | 139 | 228 |
| 13 | 1,433 | 1,008 | 127 | 137 | 744 | 783 | 207 | 316 | 126 | 190 |
| 14 | 1,162 | 765 | 127 | 137 | 501 | 527 | 207 | 301 | 111 | 190 |
| 15 | 1,037 | 676 | 127 | 75 | 474 | 499 | 113 | 298 | 109 | 189 |

is of interest here to note that, although the total fat had increased, the appearance of the blood had changed and it was less milky.

It has been observed repeatedly that marked lipemia may occur without the presence of lipemia retinalis. The plasma may resemble cream in appearance and consistency and yet the retinas may be normal. In commenting on this fact in 1931, McKee and Rabinowitch[8] stated "it would appear that lipemia retinalis is due to some condition other than the *total* amount of fat in the blood." The recent investigations of Boyd[14] are of interest in this respect. He made the following observations: (1) that the degree of milkiness was not determined by the total lipid content alone; (2) that phospholipids act as emulsifying agents and tend to permit colloidal solution of greater amounts of other fats such as neutral fats, cholesterol, and cholesterol esters; and (3) that an increase in plasma neutral fat is the first evidence of an approaching lipemia. Boyd set forth the following postulate: "One might therefore suspect that the greater the amount of phospholipid the more

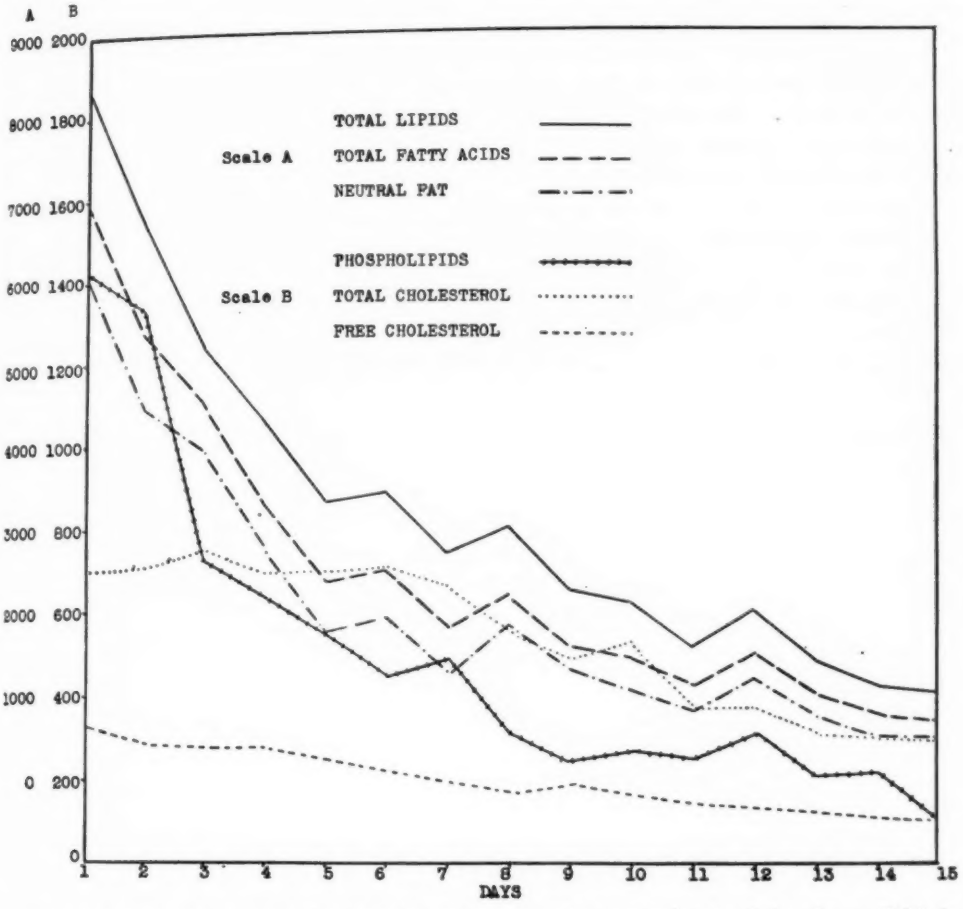


Chart 1 (McKee *et al.*). Showing the relationship of various components of the plasma lipids in a case of diabetes mellitus with lipemia retinalis.

other lipids could be held in solution in the serum. Theoretically, when the ratios of other lipids to phospholipid reach an hypothetical maximum other lipids added to plasma will not go into solution. These extra lipids would then necessarily circulate as finely divided particles or chylomicrons and would undoubtedly impart a milky appearance." As a result of his investigations, he concluded that "milky human serum ... . contains relatively insufficient phospholipid to keep the other lipids in colloidal solution and as a result the suspended particles impart a milky appearance to the serum."

This work throws considerable light on the problem of attempting to correlate total plasma lipids with the appearance of the plasma. It may also be a factor in explaining why lipemia retinalis may be found in certain individuals and not in others who may have the same or a higher concentration of total lipids. This may also explain why, in the same individual, lipemia retinalis may be present at varying levels of the total plasma fat, as in the case reported by Lepard,[12] and why, in the case reported by McCann,[13] the lipemia retinalis disappeared even though there was an increase in the total amount of fat in the plasma.

It would appear that the factors that impart a milky appearance to lipemic blood are confined to changes in the plasma. Rubin[15] found that the corpuscular lipids remained unchanged and within normal limits, and concluded that the red cells are inert in persistent (diabetic) and in transient (alimentary) lipemia.

In table 3, the results of the analyses of the various components of the plasma lipids are recorded. These are also shown in chart 1. From the data on one case, it is, of course, impossible to draw any satisfactory conclusions as to which components might be the causal factors effecting a change in the physical appearance of the blood sufficient to give a picture of lipemia retinalis. The data are recorded in the hope that with the accumulation of cases by other investigators, it may be possible to establish definitely which factor or ratio of the components of the plasma lipids is responsible for this condition.

## Summary

A case of lipemia retinalis in a 23-year-old male diabetic is reported.

The plasma lipids on admission were 8.439 percent.

Associated with the lipemia there were (1) a moderate acidosis, (2) multiple xanthomata, (3) carotinemia.

Detailed studies are presented, showing the correlation between the daily observations of the disappearance of the lipemia retinalis and the levels of the various components of the plasma lipids.

We believe this case to be the sixtieth reported in the literature.

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# THE PROBLEM OF PREVENTING PARTIAL OR TOTAL LOSS OF VISION IN GLAUCOMA PATIENTS OF EYE CLINICS*

## SOME SUGGESTIONS FOR REMEDIAL MEASURES

MARK J. SCHOENBERG, M.D.†
*New York*

Although the earlier diagnosis and control of glaucoma have been made possible by the discovery of a number of methods and procedures—such as, ophthalmoscopy, quantitative perimetry, angioscotometry, tonometric graphs, provocative tests, slitlamp microscopy, gonioscopy, activites of social workers, educational campaigns, and the like—the utilization of these discoveries has lagged behind in the very quarters to which most of the glaucoma patients are likely to apply for advice and treatment.

Unlike the procedure in many other applied sciences, it seems that in ophthalmology, the distance in time between a discovery and its universal application is, in some instances, as much as half a century, or even longer.

This situation, which has a direct bearing upon the results of our efforts to prevent partial or total loss of vision from glaucoma, is presented as the reason for submitting this contribution.

The subject under consideration consists of two parts.

Part I discusses the reasons for some of our failures, leading to the necessity of making a survey of the present methods and practices in eye clinics.

Part II develops the logical deductions derived from part I, and suggests remedial measures.

### PART I

By way of introduction, it is assumed that the following four premises are accepted by the entire ophthalmologic profession.

1. Every glaucoma patient is a potential victim of partial or total loss of vision.

2. This loss is preventable in many cases.

3. Prevention depends mainly on: (a) *early* diagnosis and early, persistent treat-

*Read at the meeting of the American Academy of Ophthalmology and Otolaryngology, at Chicago, Illinois, on October 22, 1941.

†Chairman, Committee on Glaucoma, National Society for the Prevention of Blindness, 1790 Broadway, New York, New York.

ment; (b) the patient's coöperation, understanding, and ability to carry out instructions.

4. A clear picture of the condition of the *patient,* as well as the planning of the proper medical and surgical treatment, can be obtained only by making a careful and complete study of all the essential facts and data revealed by the personal and family history; of the relationship of the patient to his environment; and of the patient as a whole.

THE SURVEY

With these four simple premises as a guide, let us examine the present system of glaucoma work in eye clinics and see whether its weaknesses may be held responsible for our failures.

A poll taken five years ago among 30 of the leading ophthalmologists of New York revealed the unanimous opinion that the methods of handling glaucoma patients in clinics are far from giving the best possible results, and that these methods are in need of being reformed.

A survey of one's own experience, derived from work in eye clinics and private practice, and an examination of the records of glaucoma patients followed over a period of at least 5 to 10 years, reveal a number of weaknesses.

Some of these weaknesses are:

1. *Overcrowding of eye clinics.* This results in lack of sufficient time for proper registration of the patients, indexing and cross-indexing of diagnoses, thorough examination, and careful recording of findings.

2. *Lack of efficiency in the organization of the entire setup in many eye clinics.*

3. *Lack of uniformity and standardization of procedures and clinical facilities; incompleteness of records.*

4. *Lack of understanding among patients* of the meaning of glaucoma and of the importance of coöperation with ophthalmologists and social workers. A large percentage of patients fail to realize the importance of regular attendance; many journey from one eye clinic or physician to another in the hope of avoiding operations; a large number of patients or their near relations do not know how (or are unable) to instill drops or introduce salve or oil into the conjunctival sac; many do not know anything about hygiene (physical or mental), and very many follow a traditional, faulty diet through their entire lifetime.

5. *Inadequate social-work service.*

6. *Insufficiency of aggressiveness in the attitude of the rank and file of ophthalmologists in matters pertaining to a campaign against blindness from glaucoma.*

Some of the data revealed by a survey of records of glaucoma patients* in three busy New York eye clinics, manned by very competent staffs, support the correctness of the statements made in the preceding discussion. Let us mention only a few details of a survey of one clinic.

1. Of an approximate total of 1,500 glaucoma patients treated during the period from 1924 to 1927, the records of only 58 were available for study. The majority of these 58 cases remained under observation for 4 to 10 years.

2. A fairly high percentage of patients came with one or both eyes in an advanced stage of glaucoma.

3. In a majority of cases, no definite information was obtainable concerning the dates of onset and of consulting an eye physician for the first time.

4. An insufficient amount of details was available in the records concerning objective findings, like size and shape of pupils, depth of anterior chamber, the condition of the lens, the appearance of the optic

* The "sample form" of the survey and the details of this investigation was published in the Archives of Ophthalmology, 1942, v. 27, p. 716.

discs, quantitative-perimetry examinations, and tonometric measurements.

5. There was no way of knowing what became of the hundreds of patients who wandered from clinic to clinic.

6. The clinical facilities were not standardized and differed in the various examining rooms.

7. Completeness and type of information found in the records varied greatly with the different examiners.

8. Provision for social service was inadequate.

9. The record room was understaffed. Hence there was no time for any research or analysis of material in the case files.

It is hoped that, as time goes on, surveys will be carried on at eye clinics in other parts of the country. Thus, data will accumulate, giving us a true picture of the weaknesses of glaucoma work and recording and adding, eventually, valuable scientific information to our store of knowledge.

## Part II

Once the picture of the present system, with its various weaknesses and shortcomings, is clearly painted, suggestions for the proper remedies follow almost automatically.*

These remedies are: (A) *the elimination of objectionable features;* and (B) *the introduction of necessary procedures.*

### A. ELIMINATE:

1. Crowding in eye clinics—the principal cause of hurried examinations and incomplete recordings.

2. Irregular attendance of patients.

3. Journeying by patients from one clinic to another.

4. Handling the patient in a manner that might frighten him or give him the impression that his case is not considered important.

5. Interviewing of a patient by a different eye man at each visit at the clinic.

### B. INTRODUCE:

1. An up-to-date system of registering, filing, indexing, and cross-indexing.

2. A full-time ophthalmologist for organizing the work and keeping it in good running order.

3. A full-time, properly trained social worker.†

4. A special glaucoma clinic, or at least a local committee to act as supervisor of the glaucoma work.

5. Training, in rotation, for all the younger members of the staff in the shortest possible time and in the most thorough manner in the art and science of making an early diagnosis of glaucoma and of properly handling glaucoma patients.

6. Up-to-date diagnostic, laboratory, and consultation facilities, with generous use of their help.

7. A printed "Form" for recording glaucoma cases. This form should contain, at least, the *minimum number* of items that are essential for a definite diagnosis and an outline of the proper treatment—a minimum below which no record should be considered acceptable.

8. A complete record of the patient's condition, to be placed at the disposal of the surgeon at a reasonable interval before operation.

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* For information concerning organization of and equipment for clinics see: "Standards for out-patient service in ophthalmology," by Conrad Berens, M.D. Amer. Jour. Ophth., 1939, v. 22, no. 8, August; and "Standards for nursing service and for medical social service," by Conrad Berens, M.D., Ruth C. Williams, and Eleanor Brown Berrill. Amer. Jour. Ophth., 1940, v. 23, no. 12, December.

† Read "The place of medical social work in ophthalmological services," by Edith M. Baker. Sight-Saving Rev., 1941, v. 10, no. 2, June; and "The role of the social worker in a prevention of blindness program," by Lewis H. Carris and Eleanor Brown Merrill. Sight-Saving Rev., 1937, v. 7, no. 4, December.

9. Clinical conferences or consultations on every patient seriously threatened with blindness.

10. A yearly survey of the glaucoma records of eye clinics.

11. Education of patients as to the importance of complete coöperation (when necessary, help in carrying out instructions).

12. An educational campaign to inform the public about the reasons for present inadequate results in treating glaucoma patients, accompanied by a plea for more financial support for eye institutions, so that the necessary reforms can be carried out.

13. An "exchange," or "glaucoma bureau," to which the names, addresses, age, and sex of all the glaucoma patients should be reported by the eye clinics of the entire city. This would make possible a census of glaucoma cases, and the collection of many other data not obtainable in any other way.

While some of these suggestions may not be acceptable to some of the readers, there is no doubt that a serious attempt to carry out most of them will result in a marked improvement of the present system of handling the problems of glaucoma patients and in a definite reduction of the percentage of blindness from glaucoma.*

The National Society for the Prevention of Blindness, through its Committee on Glaucoma, wishes to give all possible coöperation to the ophthalmologic profession in any undertaking leading to the prevention of loss of vision due to glaucoma.

This paper is dedicated to the memory of Dr. Park Lewis, one of the founders of the National Society for the Prevention of Blindness, whose heart was set on the problem of prevention of blindness from glaucoma.

*1790 Broadway.*

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* For other details read Mark J. Schoenberg's: "The general practitioner's part in the campaign for prevention of blindness from glaucoma," New York State Jour. Med., 1941, v. 41, Nov. 15, no. 22.

# FAMILIAL DEGENERATION OF THE MACULA LUTEA*

## A REVIEW OF THE LITERATURE WITH A REPORT OF EIGHT ADDITIONAL CASES

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Familial macular degeneration is the term applied to the bilateral, symmetrical degeneration of the macular region of the eyes, affecting one or several children of a family, the parents, as a rule, being free of the disease. Ophthalmoscopic examination shows a characteristic retinal picture. Only exceptionally is another generation of the family affected. The disease is believed to be congenital, and is familial, rather than hereditary, in type. The condition is chronic, manifesting but few signs or symptoms at the onset, and progressing to a serious impairment of central vision, after which it remains stationary. There is little impairment of peripheral vision, however, and complete blindness never occurs. Night-blindness is not present; on the contrary, the vision is usually better in a dim light.

Heretofore, most writers have described the condition as one that usually appears at or shortly after puberty, only rarely earlier than this, at the age of second dentition—that is, when the child is between five and seven years of age. According to most authors, when the same retinal picture was seen in these young children, there were accompanying cerebral symptoms, often ending in dementia. To this group the term cerebromacular degeneration was applied. Familial macular degeneration, on the other hand, is seen in persons who are otherwise normal and healthy and who exhibit no signs of mental disturbance.

* From the Department of Surgery, Division of Ophthalmology, University of California Medical School. Candidate's thesis accepted for membership in the American Ophthalmological Society, May, 1941.

It will be shown, by the presentation of a series of eight cases, that familial macular degeneration often appears about the age of six years—long before the onset of puberty—in children without other disease who show no mental deterioration. We believe that the age of onset of the purely macular type is variable and bears little or no relation to puberty; that no classification of type or prognosis as to longevity can be based on age alone.

### HISTORY

Knapp,[1] in 1870, reported a case which he described as "a peculiar form of retinitis pigmentosa"; the description of the condition, however, is suggestive of familial macular degeneration. The patient, a female, aged 35 years, had suffered from a slowly progressive diminution of vision for 10 years. Both eyes were similarly affected, the lesions being located about the central area of the retina, and being described as "whitish, opaque, studded with the characteristic bone-corpuscle-like pigment spots." In addition, "throughout the whole retina, except in the outer, upper quadrant, white diffuse specks were scattered among the black ones." Otherwise the retina was normal. The peripheral fields were normal, but there was a large central scotoma corresponding to the degeneration in the region of the macula lutea. "Eccentric vision not materially impaired. She does not find her sight much worse at night than during the day."

Except for the statement that the parents were not related, no mention was made of the other members of the family, so that it may be assumed that the patient

was the only one in the family thus affected.

This may or may not have been a case of familial macular degeneration, but the symmetric nature of the lesions in the two eyes, the location of the lesion in the macular region, with white specks scattered throughout the retina, the central scotoma with preservation of the peripheral fields, the absence of night-blindness and of a history of heredity, all are strongly suggestive of familial macular degeneration.

In 1897 Batten[2] first described the disease as we know it when he reported a symmetric degeneration of the macula occurring in two brothers at the age of 14 years. The younger brother, aged 14 years, showed "in both eyes, at the macula, a dark, pear-shaped patch of a red color dotted over with fine points of retinal pigment. Surrounding the macula there is an area of retinal disturbance dotted over with ill-defined yellowish white dots." The vision was reduced to 6/60 in each eye, and was not materially improved by correction. The visual fields showed no peripheral contraction, but there was a central scotoma for colors only.

The older brother, aged 21 years, displayed a similar condition, but the changes were more advanced. The entire macular region showed chorioretinal changes, with a small central deposit of fine dotted pigment. The vision was reduced to 6/36 in each eye. There was one other living child in the family, a sister, who was said to have "good sight." The parents had no ocular diseases, but their histories were suggestive of syphilitic infection.

The failure of vision first manifested itself in both boys when they were about 14 years of age. The onset was gradual, and the changes were symmetric. "The condition of the fundus in the elder brother probably represents a later change of the condition now commencing in his brother's eyes." In the older brother the disease had been stationary for several years.

Stargardt,[3] in 1909, published the histories of seven children in two families affected with familial macular degeneration. In the first family there were four children, all of whom presented a similar retinal picture. The parents were healthy and had no ocular disease nor mental aberrations. The ages of onset for a female was 14 years, and for each of the three boys it was 15 years. All showed macular changes ranging from "loss of foveal reflex" and "slight irregularity of the macular pigment which might be considered normal," to a "gray-yellow patch with pigmented margin." The presence of the typical delicate gray or yellow flecks scattered about the retina along the retinal vessels was particularly noted. Each child had a central scotoma with normal peripheral fields.

In the second family there were five children, three of whom—all boys—exhibited the disease. The parents were healthy and manifested no ocular abnormalities. The age of onset for the three boys was 12, 13, and "10 or earlier." The retinal changes were identical with those present in the first group. Stargardt directed attention to the symmetric nature of the lesion in the two eyes, the absence of changes in the retinal vessels (unlike retinitis pigmentosa), the retention of some central vision, the characteristic changes in the fields, the absence of a history of heredity, and the good general health and normal mentality of the patients. Temporal pallor of the optic disc was observed in a few cases.

Stargardt also cited an unpublished case of Leber's, in a girl aged seven years, who was said to have an atypical retinitis pigmentosa. In this case the nar-

row retinal vessels, the changes in the peripheral retinal pigment, and the extreme loss of vision ("finger counting") raises the question whether or not this case belongs in the group classified as familial macular degeneration.

In the same year Jennings[4] reported the cases of three children in one family—two sisters, aged 19 and 21 years, respectively, and a brother, aged 17 years. Since childhood all had had defective sight which was slowly getting worse. The vision varied from 10/200 to 20/200. They could all read by holding the print about four inches away. Each had a central scotoma with normal peripheral fields. The fundi showed "in the macular area a horizontal oval patch larger than the optic disc, of a gray color, the gray stippled." Surrounding this patch there were from 18 to 20 white dots.

In 1911 Lutz[5] reported a family in which there were nine children, four sisters of whom had the disease. The age of onset was from 10 to 12 years. In the oldest one the symptoms persisted to the age of 78 years without appreciable change. Among the youngest the changes were entirely macular; in the older ones the changes affected the surrounding area, but did not extend to the peripapillary zone. Loss of foveal and macular reflexes was present in all.

In the same year Oatman[6] reviewed the subject of familial macular degeneration, dividing it into two types. In one—the maculocerebral type—both retina and brain were attacked. In the other—the macular type—the pathologic changes were limited to the retina. The "one constant characteristic manifestation common to both types is a degenerative process in the retinal macula." According to this observer, the earliest ophthalmoscopic change consists of slight disturbance of the pigment of the retinal epithelium, which might be regarded as within normal limits, but failure of visual acuity may precede this. "Later the picture is that of atrophy and pigmentation of the retina in the macular region, both eyes being invariably affected." Oatman found the changes in the perimetric fields to consist of a central scotoma of steadily increasing density, with normal peripheral fields. In his opinion, the macular-type changes—that is, the type in which the intellect is not affected—develop later than the maculocerebral-type, usually appearing between the ages of 14 and 16 years. In one case, the earliest, the disease appeared at the age of 10 years.

Our own experience fails to substantiate these findings, for, as will be shown further on, in seven of our eight patients the symptoms appeared long before puberty, and none manifested any demonstrable cerebral changes.

Stirling,[7] in 1912, reported three cases occurring in a family in which there were six children. In all three the disease manifested itself at about the age of eight years. The following year Stargardt[8] reported three new cases. The loss of vision began at the ages of 10, 14, and 14 years, respectively. In 1914 Darier[9] reported two females affected in a family of five children, in whom the condition appeared "in childhood." In a second family, in which there were seven children, three boys were affected. In one boy the disease began at the age of 7½ years; the ages of the others were not mentioned. In elaborating a symptom complex, Darier stated that "the beginning of the affection, in general insidious and progressive, is on the average about the twelfth year."

Pusey[10] found, in a family in which there were eight children, that five were affected, the disease appearing in one child at the age of 11 years, and in the others at the age of 12 years.

Feingold,[11] in 1916, reported three cases, the children of a consanguineous

marriage of Russian Jews. The date of onset of the disease could not be fixed in the case of two of the patients, and was given as 22 years in the third.

Clark[12] wrote, in 1918: "This familial macular degeneration without dementia begins during the period of puberty, between the ages of 12 and 14 years. This is in marked distinction to the maculo cerebral type, the form with dementia, which begins between the fifth and seventh years, the period of second dentition." He stated further: "I am inclined to regard familial macular degeneration with, and familial macular degeneration without, dementia as the same disease. Why the onset of one type occurs at the time of second dentition and is accompanied by cerebral degeneration, while the onset of the purely macular type occurs at puberty and is not accompanied by cerebral changes, remains to be explained."

Clark found 37 cases of macular degeneration without dementia reported to 1918. Of these, Stargardt had reported 10 cases occurring in three families. Regarding the etiology, Clark, in analyzing these cases, found only three that gave a history of consanguinity of the parents (Jennings's case). He also stated: "Concerning the evidence of syphilis as a causative factor, 22 are definitely non-syphilitic, in 10 cases the point is not mentioned, and in two cases the parents may have been syphilitic but the children showed no sign of hereditary syphilis." In only three cases, those reported by Feingold,[11] were the children Jews; in this they differ from cases of Tay-Sachs disease, in which most of the children are Jews.

Blue,[13] in 1919, reported a family in which there were two girls, the elder of whom developed the disease at the age of 12 or 13 years, the younger being unaffected. The father of these girls developed the same condition at the age of 35 years; this was one of the few cases reported in which two generations were affected. In his summary, Blue stated that: "The disease manifests itself between the ages of 7 and 14 years, the majority developing between 10 and 14 years, the period of adolescence." This observer made a statement which we consider of very great importance—one borne out by our own cases—when he wrote: "The cases that develop before and after puberty differ in no way from those that develop during this epoch of life."

Behr,[14] in 1920, reported eight cases occurring in two families, the average age at onset being about eight years. He classified these cases under the heading, "Infantile macular heredo-degeneration." In addition to commenting upon these cases, Behr reported that in the case of Stargardt's patients, whom he reëxamined after an interval of 17 years, no great change had taken place in the appearance of the lesions nor in the symptoms.

Alkio,[15] in 1923, believed that in each affected family there is a particular time of appearance and a certain course of development of the disease that are peculiar for that family.

Knapp,[16] in 1928, reported six cases occurring in five different families:

(1) A male in whom sight began to fail at 10 years.
(2) A female of 15 years, "whose sight had been poor for several years."
(3) A female in whom the onset occurred at the age of 20 years.
(4) A male aged 19 years, with "poor sight for many years."
(5) A male with poor vision discovered at the age of 13 years.
(6) A male in whom the disease occurred at the age of 13 years.

In this series the earliest age at onset

was probably 10 years; in the others the disease appeared some time about puberty, and certainly in the second decade of life. In five of these cases there was no family history of ocular disease, although in one retinitis pigmentosa was present in two uncles. Two of the children affected were of the same family, whereas five other children in the family were free of the disease.

Knapp[16] commented upon the similarity of the central lesion in all these cases, the peripheral retina being normal. None of the patients showed changes in the retinal vessels, but three had temporal atrophy of the optic disc. Amblyopia varied from 20/40 to 8/200, and no child showed hemeralopia. This author wrote: "In the associated condition, maculocerebral degeneration, the ocular disturbance begins at an earlier age. In the group just outlined the process is a milder one, beginning later in life." Our own cases, however, show that familial macular degeneration can and often does appear as early as six years of age.

Larsson,[17] in 1932, reported five new cases occurring in three families. The patients were all males. The disease manifested itself in two brothers aged 12 years, in two other brothers aged 15 years, and in another aged 17 years. All the patients exhibited similar ophthalmoscopic findings and "the typical disturbance of function." Larsson commented upon the marked sensitivity to light in these patients—the extreme photophobia to bright light—making it difficult to examine the fundi with the Gullstrand ophthalmoscope. We found this sensitivity to bright light to be present in many of our patients, so that photographing the fundus was difficult in all cases and impossible in many.

Sorsby,[18] in 1940, in an article on "The dystrophies of the macula," said: "A large group has these unifying features:

"1. Familial occurrence.
"2. A bilateral fundus lesion confined essentially to the macular area.
"3. Onset at about 8 to 14 years of age.
"4. Progressive course, leading to loss of central vision and no peripheral involvement."

Sorsby remarked that there is probably no fixed age limit for the appearance of macular dystrophies, for the lesion may be present for some time before symptoms appear. When we speak of the age at onset we refer to the appearance of symptoms, not to the appearance of the lesion, and visual defects may not be noticed by some patients though the lesion is well advanced.

Duke-Elder,[19] in 1941, wrote: "In general terms it may be said that the earlier the lesion appears, the more severe it is and the more likely it is to be associated with mental symptoms."

Others who have reported cases and described the condition are Best,[20] Chance,[21] Gifford,[22] Lloyd,[23] Doyne,[24] Scheerer,[25] Morelli,[26] Steyn,[27] Wright,[28] Schall,[29] Bailliart,[30] Gasteiger,[31] and Lijo Pavia.[32]

## Description of the lesion

The ophthalmoscopic picture is essentially that of a localized retinal atrophy limited to the macular region. The first sign observed in all of our patients was loss of the normal foveal reflex, so that the retinal atrophy probably begins at the macula, and as it progresses affects the perimacular region. The early ophthalmoscopic signs indicate an alteration of the retinal pigment, although these signs are so slight that, without subjective loss of vision, they might be overlooked.

In the patients in whom the condition had existed for some time a more advanced picture was presented. In these cases there was in each macular area a region, usually horizontally oval, varying

in size from 0.75 to 2 disc diameters, having well-demarcated borders, the entire area appearing to be slightly depressed. The background was of a salmon-pink color. A striking feature was the great aggregation of light reflexes that was seen in this affected area. As the ophthalmoscopic light was moved about, myriads of irregular reflexes appeared, presenting the appearance of a copperlike metallic sheen. Scattered more or less uniformly throughout the area were numerous fine brown or black pigment granules, appearing as though brown pepper had been dusted about. The involved area seemed paler and atrophic and suggested a rarefaction of the normal retinal pigment. In none of our cases could the foveal reflex be made out with certainty.

In the well-advanced cases, in which the depigmentation was complete, the choroidal vessels were exposed. The lesions in the two macular areas were identical.

Scattered about the retina, and extending well beyond the area described, were small, pale, light spots, somewhat resembling drusen in appearance, lying beneath the retinal vessels situated in the deeper retinal layers. These probably represented colloid bodies. They do not have the appearance of exudates, and may, as suggested by Oatman,[6] have been further evidence of degenerative changes, with exposure and thickening of the lamina vitrea. They were so pale and indistinct as to be easily overlooked unless actually searched for. They could be seen only by direct ophthalmoscopic inspection and seemed to fade as the light was moved away from them. In our patients no atrophy of the optic nerve was seen, but it may occur as a secondary manifestation of the retinal degeneration, and has been observed occasionally by other workers.

Sorsby[18] remarks that there is no conclusive evidence that the pallor observed in some cases extended beyond the normal physiologic limits.

Narrowing of the retinal vessels has been described in a few cases, but was not present in any of our patients. I feel that the presence of normal retinal vessels is an important point in differentiating this disease from atypical forms of retinitis pigmentosa. No signs of inflammation, exudates, or hemorrhages have been seen. The peripheral retina was normal.

The striking features in all the cases are the symmetric nature of the lesion in the two eyes, and its sharply circumscribed, circular appearance. Studies of the perimetric fields show no changes in the peripheral fields but disclose the presence of a central scotoma of variable density. This finding is borne out clinically by the reduction of the central vision to 6/60, in most of the cases, without loss of peripheral vision. Many of the patients are able to read newspaper print if it is held very close to the eyes.

## Prognosis

The loss of central vision is said to be fairly rapid in the early stages of the disease, after which the condition becomes stationary. In most cases this is a difficult point to determine. Many of the patients are not aware of the fact that their vision is defective until they have been examined in the routine school tests. The majority of the patients are young children, and their impairment of vision may escape the notice of parents and teachers for several years. The fact that the eyes appear normal and that the children are able to read, although often with difficulty, makes this particularly likely. In some cases the condition is not suspected until a brother or sister, in whom the condition is farther advanced, is examined by an ophthalmologist. When the vision falls to about 6/60, no further loss occurs, but no improvement in the condition has ever been reported. Batten[2] stated that the two patients on whom he had reported

in 1897 showed little or no change in the condition of the fundus or in vision when seen some 26 or 27 years later.

Behr,[14] in commenting on his cases and on those of Stargardt, which he reëxamined after an interval of 17 years, stated that it is particularly noteworthy that the disease eventually becomes stationary, and apparently remains so thereafter. In fact, it seemed that in some cases an actual improvement had been observed.

From a study of the literature it may be stated that no case has been reported that ended in blindness. In the case of most patients, indeed, some central vision is retained, and in all cases normal peripheral vision remains. Vision with reduced illumination is amazingly good, and out of all proportion to the objective signs.

### Etiology

The etiology of this condition has not been determined. Treacher Collins[33] considered these cases of familial macular degeneration as ophthalmic abiotrophies. In his classification he included retinitis pigmentosa, amaurotic family idiocy, Leber's optic atrophy, and Doyne's familial choroiditis. There is no convincing evidence that congenital syphilis was a causative factor in any of the reported cases, although some of the earlier writers considered it as a possible influence. None of our patients showed any evidence of syphilitic taint. Consanguinity, race, the health of the parents, and the like could not be regarded as etiologic factors. Except in the findings in the eyes, the unaffected children in the family differed in no wise from their unfortunate brothers or sisters. In every case an effort was made to trace the family history back as many generations as possible, and in no case was a second generation known to be affected. Complete physical examinations were made on all of our patients; these included blood studies, basal metabolic estimations, neurologic and psychiatric tests, vitamin studies, and the like, but no factors could be found that had any bearing on the disease.

### Pathologic changes

No histologic studies of familial macular degeneration have ever been published.

Larsen[34] reported a study of an eye in a patient with total color blindness, and numerous studies on the eyes of patients with cerebromacular degeneration have been made, but there is no reason to assume that any relation exists between these diseases and familial macular degeneration. The symptoms suggest a degeneration of the cones confined largely to the macular region, although it may extend somewhat beyond this area. Such a lesion offers an explanation for the day blindness.

Duke-Elder[19] stated: "About the pathology little is known; presumably it corresponds to that characterizing the outer, retinal layers in juvenile family amaurotic idiocy." In the latter condition the outer retinal layers disappear, to be replaced by neuroglial proliferation. The retinal pigment migrates into the degenerated area. In addition, there is a lipoid degeneration of the ganglion cells. The choroid is found to be normal, suggesting the fact that the degeneration of the neuro-epithelium is a primary one.

The disease begins as an atrophic degeneration of the macula, with rarefaction of the pigmented epithelium. This depigmentation may progress until the choroidal vessels become exposed. There is no proliferation of pigment in the area affected, and there is no scattering of the pigment to the surrounding area, such as is seen in retinitis pigmentosa. Beyond the affected central area the only abnormalities noted ophthalmoscopically are the small white specks which are considered by most investigators to be caused by changes in the lamina vitrea of the cho-

roid. The optic nerve may exhibit more or less temporal pallor, but there is no frank atrophy. The retinal vessels are normal in appearance.

Leber[35] believed this disease to be one of the forms of tapetoretinal degeneration of the macular region, and regarded the white spots scattered about the retina as drusen. He suggested that they may be colloid bodies in a partially calcified condition.

### Differential diagnosis

Four other conditions—namely, cerebromacular degeneration, retinitis pigmentosa, retinitis punctata albescens, and central choroiditis—must be considered in making the differential diagnosis.

Cerebromacular degeneration is one of the diseases included by Duke-Elder[19] in his classification "Familial lipoid degenerations." It represents a juvenile form of amaurotic family idiocy. It has all the characteristic retinal changes present in familial macular degeneration, but, in addition, there is involvement of the central nervous system. The cerebral symptoms vary from mental retardation to imbecility, and paralysis, epileptiform convulsions, and dementia are not infrequently encountered. These central-nervous-system changes begin simultaneously with the retinal ones, but rapidly assume a major role. The ophthalmoscopic picture is identical with that of familial macular degeneration, except that, in cerebromacular degeneration, atrophy of the optic nerve is a fairly common finding. Optic-nerve atrophy has never been reported in familial macular degeneration, although temporal pallor of the optic disc has been observed occasionally. Nystagmus and eccentric fixation are frequently present in cerebromacular degeneration, but the former is rarely found in familial macular degeneration. Cerebromacular degeneration is invariably progressive, the prognosis depending to some extent upon the age of the child. The younger the child, the more rapid is the course, death occurring, as a rule, before the tenth year. The most important factor in making the differential diagnosis is the presence in cerebromacular degeneration, of neurologic changes, and their absence in familial macular degeneration.

Patients with familial macular degeneration are normal mentally, and, indeed, quite often above the average in intelligence. In spite of their visual handicap such children learn to read and write, and adults show no mental aberration.

Retinitis pigmentosa, even in its atypical forms, presents few features common to familial macular degeneration. Retinitis pigmentosa is a hereditary condition, whereas familial macular degeneration is, as its name implies, familial, only rarely affecting a second generation. Retinitis pigmentosa affects particularly the peripheral retina, and is accompanied by contraction of the retinal vessels, a peculiar atrophy of the optic disc, lenticular changes, night blindness, and contraction of the peripheral field. Familial macular degeneration, on the other hand, is confined to the region of the macula and to the posterior pole. Except for occasional temporal pallor of the optic disc, the fundus is otherwise normal. Patients are able to see better in a dim light, night blindness being invariably absent. The perimetric tests show a central scotoma with normal peripheral fields. Retinitis pigmentosa displays a tendency to progress slowly throughout the life of the individual, so that eventually only a small island of central vision remains. In familial macular degeneration, on the other hand, the central vision is impaired quite early in the disease, but after reaching a certain point, the condition becomes stationary and no further loss ensues.

Retinitis punctata albescens is one of those retinal diseases classified by Leber[35] as a tapetoretinal degeneration, and by

Duke-Elder[19] as one of the primary retinal degenerations. It is a familial disease, is degenerative in type, and is characterized by the presence of innumerable white dots, similar to those seen in familial macular degeneration, scattered throughout the fundus. No pigment changes are visible, however, and the characteristic macular lesion that is seen in familial macular degeneration is absent. The disease, like familial macular degeneration, appears in childhood. The condition is not progressive. The patients complain of night blindness, whereas in familial macular degeneration the vision is better in a dim light. Other characteristics which differentiate this conditon from the one under consideration are that the visual fields show peripheral contraction, that optic atrophy is present, features that are absent in familial macular degeneration. In many cases good central vision is retained.

Familial choroiditis, which was also classified by Leber[35] as one of the diseases in the tapetoretinal-degeneration group, presents some characteristics that are seen in familial macular degeneration. This form of choroiditis is a familial disease, affecting the macular region of both eyes, but the lesions are asymmetric, and therefore unlike the lesions of familial macular degeneration, which are invariably identical. The ophthalmoscopic picture of familial choroiditis differs from that of familial macular degeneration in another particular; that is, it is accompanied by inflammation, with areas of extensive atrophy, marked pigment changes, hemorrhages, cicatrices, and exposure of the choroidal vessels. The lesions of familial macular degeneration are those produced by degeneration, with no evidence of inflammation.

## Comment

A review of the literature on degenerative diseases of the macula shows that there is considerable confusion as regards classification. Some authors would classify all forms of symmetric macular degeneration under the head of "Tapetoretinal degeneration." Pillat[36] formulated an excellent and adequate classification. He reserved the term tapetoretinal degeneration for various types of retinitis pigmentosa, including retinitis pigmentosa sine pigment, retinitis albescens, and so forth. He classified heredo-degeneration of the macula, with or without dementia, in a second group, which includes a number of macular conditions, such as familial choroiditis, choroiditis guttata, and the like. Under this classification would be placed familial macular degeneration. A study of our cases, as well as of those previously reported, shows that there are certain common characteristics that serve to identify the group. Familial macular degeneration is a disease affecting several but not necessarily all the children in one family. Only rarely has it been reported as affecting a second generation. It is a chronic familial condition, probably congenital, that runs a progressive course until central vision is seriously impaired, and then it seemingly remains stationary. It is bilateral and symmetric with characteristc changes in the fundi that are limited largely to the region of the macula and posterior pole. The peripheral retina remains normal throughout, except for the tiny white drusenlike spots seen in some, but not in all, cases. The patient is otherwise healthy and normal, the only subjective symptom being dimness of vision.

Blue[13] reported a case of familial macular degeneration appearing at seven and a half years of age, and Stargardt[3] published a report of one occurring at the age of eight years. In seven of our cases the condition appeared before the age of eight years. It is possible that had the visual testing of young school children been practiced years ago, in many of the

cases that were reported with an onset at the age of puberty visual deterioration would have become evident much earlier. Stargardt[3] asserted that the subjective disturbances never begin suddenly, so the disease may have begun earlier than noted. This observer brought out the point, however, that all his patients displayed good handwriting, which is suggestive of the fact that the disease did not begin during the first years of school life.

## Case histories

*Case 1.* H. H. F., a white female, aged eight years, was first seen in the eye clinic on June 11, 1932. She had noticed poor vision for the six months preceding our first examination.

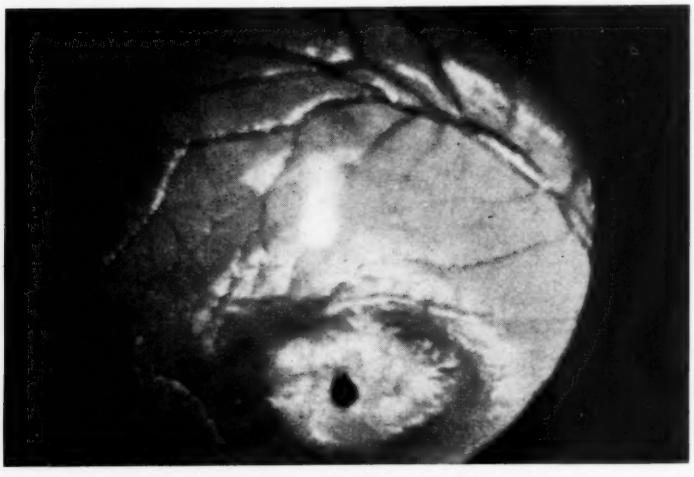

Fig. 1 (Crawford). Case 1, H. H. F., right eye.

The vision in either eye without correction was 20/50.

External examination showed that the lids were normal, ocular motility was unaffected in the cardinal directions of gaze, the eyes were steady under cover for near vision and distance; the pupils were normal in size for the patient's age, round, equal, and active to both light and accommodation. The palpebral and bulbar conjunctivae of each eye were normal, as were also the sclerae. The corneae showed no abnormalities when viewed by oblique illumination or the slitlamp.

Fundus examination disclosed that the discs of each eye were normal in color, outline, and cupping, and that the vessels were normal in caliber, color, and ratio of arterioles to veins. The peripheral retina of each eye showed no pathologic changes. In the maculae, however, there were identical changes. A horizontally oval area, about 1¼ disc diameters in size, was seen, with sharp and distinct borders, the whole appearing somewhat depressed and much lighter in color than the surrounding retina. As the ophthalmoscope light was moved over this area, numerous light reflexes that gave the appearance of lights being reflected from an uneven metal surface could be seen. Scattered throughout the area of the lesion and clearly visible between the bright reflexes were granules of brown and black pigment, which in the right eye had coalesced to form a large clump of black pigment in the foveal region. The pigment in the left eye showed no tendency to coalesce. The foveal reflex was absent in each eye (fig. 1).

Visual fields, taken on a standard perimeter, using a 3-mm. white test object at 330 mm. and 7 foot-candles of light, showed normal peripheral limits. Central fields, taken on a tangent screen, using 10 foot-candles of light and a 2-mm. white test object at 2,000 mm., showed bilateral central scotomata that measured 2 degrees. The blind spots were normal in size, shape, and position, and the limits of the central fields were 28 degrees for each eye. When tested by the Ishihara method, the color sense was found to be normal, and there was no history of night blindness; in fact, the vision was believed to be better in dim light, but this may have been the result of a slight amount of photophobia.

Refraction under homatropine showed a small amount of hyperopic astigmatism, but the vision was not improved by correction of the refractive error.

On June 18, 1932, the patient was sent to the Pediatrics Department of the University of California Medical School, on the service of Dr. Amos Christie, for a general physical examination. Her only complaint was of poor vision of six months' duration, when she was in the second grade. No evidence of poor vision existing prior to this time was elicited.

The family history showed that both parents were living and well, there was no blood rela-

tionship, and that both had good vision, although the mother was wearing a correction for hyperopic astigmatism. One maternal uncle, who was not available for examination, was said to have had poor vision in one eye since childhood. The family consisted of four children, of whom the patient was the fourth. Two children had normal vision, but the third (case 2) was affected in the same way as this patient.

The patient was born five weeks before term, delivery being by version extraction; weight at birth, four pounds. Development was normal. A tonsillectomy was performed at the age of five years, and the only childhood disease was chickenpox. Physical examination showed the patient to be well developed and nourished; the teeth were in good condition; the heart and lungs were normal; the abdomen and the extremities were negative; a neurologic examination was also negative. Complete blood count and urinalysis gave normal findings. The blood pressure was 90/48. The temperature, pulse, and respiration were normal. An intelligence test, made by the Stanford-Binet method by P. Bretnall, of the Children's Psychiatric Department, showed an I.Q. of 126, and disclosed that the patient was very coöperative. A tuberculin and a blood-Wassermann test were negative.

Subsequent examinations, both ocular and physical were made in March, 1933, April, 1936, May, 1939, and November, 1940. At the last examination the vision was 20/100 in each eye, and could not be improved with lenses for a small hyperopic astigmatic error.

Physical examination by Dr. Amos Christie in November, 1940, showed that the blood pressure has remained low, 96/62, and that there was more hair on the legs than normal. It was suggested that some adrenal disturbance might be responsible for these abnormalities.

*Case 2.* R. L. F., a white female, aged 12 years, a sister of the patient described in case 1, was first examined in the eye clinic on June 11, 1932. She stated that her vision had been poor for at least four years, and she believed it to be growing worse.

On examination the vision in either eye was found to be 20/180, and with correction for a small degree of compound hyperopic astigmatism it remained the same.

External examination showed that the lids and lashes were normal, the ocular motility was normal, and the eyes were steady under cover in the cardinal directions of gaze. The pupils were normal in size and were round, equal, and active to light and accommodation. The palpebral and bulbar conjunctivae and the sclerae were normal. Both corneae were normal by oblique and ophthalmoscopic examinations, and the remainder of the media of both eyes showed no pathologic changes.

Fundus examination disclosed that both optic discs were normal in color, outline, and cupping, and that the vessels were normal in caliber, color, and ratio of arterioles to veins. The peripheral parts of each retina were perfectly normal in color, and no changes in the pigment were observed.

The maculae were identical in appearance, so only one will be described. There was an area,

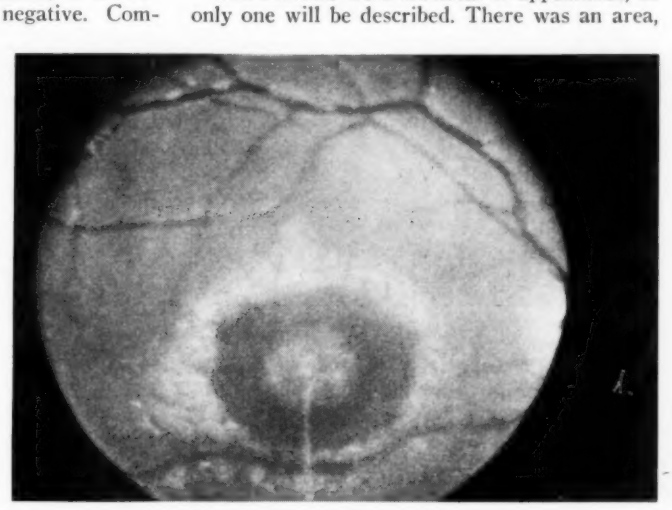

Fig. 2 (Crawford). Case 2, R. L. F., right eye.

approximately three-quarters disc-diameter in size, which, because of a patchy degeneration of pigment, was granular and lighter in color than normal. There were many reflexes as the ophthalmoscope light was moved over this area, although the normal foveal reflex was entirely absent. Surrounding this granular central area was a horizontally oval band which was smooth in appearance and which seemed to contain more pigment than normal. Both the depigmented central area and the heavily pigmented ring appeared to be depressed below the level of the surrounding normal retina (figs. 2 and 3).

Peripheral visual fields were taken on a standard perimeter, using 7 foot-candles of light and a 3-mm. white test object at 330 mm. The limits of the field for each eye were

normal. Central fields were taken on a tangent screen with 10 foot-candles of light and a 2-mm. white test object at 2,000 mm., and showed bilateral central scotomata measuring 1½ degrees; the limits of the central field were 27 degrees for each eye. The color sense was normal when tested by the Ishihara method. There was no night blindness; in fact, the patient stated that her vision was better in dim or reduced light.

The patient was seen by Dr. Amos Christie, of the Department of Pediatrics, University of California Hospital, and was hospitalized for a complete study.

Two points in the family history were relevant; namely, a maternal uncle had had poor vision in one eye since childhood and a younger sister (case 1) had the same affection as the patient. The patient was born five weeks prematurely, delivery was normal, and the weight at birth was six pounds. The child was fed on a formula of cow's milk, and no cod-liver oil or orange juice was given. Early development, however, was normal. The childhood diseases included otitis media at 14 months, chickenpox at 5 years, measles at 5 years, tonsillitis at 5 years, and scarlet fever at 10 years of age.

A physical examination showed a well-developed and well-nourished white female, aged 12 years, with undeveloped secondary sex characteristics. The scalp was dry, and the hair on the head was thick. The left ear drum was perforated. The nose, throat, and mouth were normal as were chest, abdomen, and extremities. The heart and lungs were normal.

Laboratory tests, urinalysis, and blood count gave normal findings. The blood-Wassermann and tuberculin tests were negative, and the test for glucose tolerance was normal. The basal metabolic rate was 2 percent minus.

A psychometric study was made and the I.Q. was found to be 118.

Subsequent examinations, both general and ocular, made in March, 1933, December, 1933, April, 1936, May, 1939, and November, 1940, showed normal mental and physical development; there were no demonstrable changes in the macular disease, nor had the retinal vessels undergone any changes. The patient was graduated from public high school at the age of 18 years, and continues to be of superior intelligence.

Fig. 3 (Crawford). Case 2, R. L. F., left eye.

*Case 3.* C. T., a white male, aged 13 years, was first seen in the eye clinic on February 10, 1938. According to the parents, the onset of poor vision occurred at the age of seven years.

Examination showed that the vision of the right eye was 14/200 uncorrected, and that of the left eye, 10/200 uncorrected. The patient wore glasses prescribed by an optometrist, but these did not improve his vision in either eye.

On external examination the lids and lashes were found to be normal. There was no impairment of ocular motility, but fixation was so poor that a test of muscle balance could not be made. Each cornea was normal when seen by oblique illumination, and the other media of each eye were normal when viewed by both the corneal microscope and the ophthalmoscope.

The fundi were exactly alike so that a description of one is sufficient. The disc was normal in color, outline, and cupping; the vessels were normal in caliber, color, and ratio of arterioles to veins. Throughout the peripheral retina, there were scattered numerous tapiocalike retinitic spots that were difficult to see unless the light from the ophthalmoscope was directed at a certain angle. There was a loss of the normal foveal reflex, and a granular degeneration or depigmentation of the macula, which measured about 2 disc diameters. The borders of this area were sharp; there were no clumps of pigment and no exudates. The entire area of the lesion was lighter in color than the surrounding retina.

Visual fields, taken on a standard perimeter, using a 3-mm. white test object at 330 mm. and 7 foot-candles of light, showed normal peripheral limits. Central fields, taken on a tangent screen, using 10 foot-candles of light and a 2-mm. white test object at 2,000 mm.,

showed bilateral central scotomata of approximately 5 degrees above the horizontal and 2 degrees below the horizontal. The limits of the central fields were normal. When tested by the Ishihara charts, the color sense was normal, and there was no history of hemeralopia.

The patient was examined in the Pediatrics Department on the service of Dr. Mary Olney. The family history, so far as previous generations were concerned, was negative. Two brothers (cases 4 and 5) were similarly affected.

This child was born at term and delivery was normal. During early childhood the patient had chickenpox, pertussis, measles, and mumps; there was no history of scarlet fever, diphtheria, or of contact with tuberculosis. There was an overexposure to sun when the patient was seven years old. At the age of five he "nearly had spinal meningitis," although the details were not clear, nor did the illness last more than a few days. The patient was subject to frequent attacks of asthma.

Physical examination on February 11, 1938, showed a well-developed and well-nourished boy aged 13 years. The skin was warm and dry, there was no adenopathy; the ears, nose, and throat were normal as were also the mucous membranes. The teeth were in good condition. There were no abnormalities in the chest, heart, lungs, or abdomen. The extremities showed no clubbing nor edema. All reflexes were physiologic except the left upper abdominal reflex, which was not elicited. Sensations for touch, pain, and temperature were normal. Tuberculin and blood-Wassermann tests were reported as giving negative reactions. A complete blood count and urinalysis gave normal findings.

Subsequent examinations, both ocular and physical, were made in August, 1938, September, 1939, and February, 1940. The patient's development, both physical and mental, has been entirely normal except for the changes in the fundi.

*Case 4.* F. T., a white male, aged 11 years, was first examined in the eye clinic on February 10, 1938, because of poor vision. The parents stated that the defective vision had appeared as early as the boy's sixth year, and that many examinations had been made, usually by optometrists.

The vision in each eye was 20/200 uncorrected. Refraction under homatropine showed a small hyperopic error, but correcting lenses did not improve the vision in either eye.

On external examination the lids were found to be normal; the bulbar and palpebral conjunctivae were normal, and the tension of each eye measured by palpation was normal. There was no impairment of ocular motility. A muscle-balance test with a Maddox rod was attempted, but poor fixation made this inaccurate. No pathologic changes in the corneae were found with the corneal microscope.

Fundus examination showed that, viewed with the ophthalmoscope, the other media of each eye were normal. Each disc was normal in color, outline, and cupping, and all retinal vessels were normal in caliber, color and arteriolovenous ratio.

The macula of the right eye showed an area of degeneration measuring about 3 discs diameters in size. The entire area presented a spotty depigmentation, with numerous light reflexes and a sharp border. There was no clumping of pigment, but instead, a patchy diminution of pigment. No foveal reflex was present in either eye. Scattered throughout the peripheral fundus of the right eye there were numerous small white retinitic spots that were difficult to see. The pathologic changes in the left eye were essentially the same as those in the right eye. There was no hemeralopia.

Peripheral visual fields were measured on a standard perimeter, using 7 foot-candles of illumination and a 3-mm. white test object at 330 mm. The limits of the field for each eye were normal. Central visual fields were taken on the tangent screen with 10 foot-candles of light and a 3-mm. white test object at 2,000 mm. These fields showed a central scotoma of 10 degrees in the right eye, and one of 15 degrees in the left eye. The limits of the central fields were normal. There was no color blindness.

The patient was seen in the Pediatrics Department, University of California Hospital, on the service of Dr. Mary Olney. The only complaint was of poor vision, which was said to have occurred when the patient was "in the first grade." The family history was relevant (the patient is a brother of the patients described in cases 3 and 5). There was no history of diabetes, high blood pressure, cardiac disease, or insanity in the family.

The patient was born at full term and weighed 7½ pounds, and the delivery was normal. He was breast-fed until he was eight months old, and was given a formula until one and one-half years of age. Orange juice was administered daily from the age of four months, but he did not have cod-liver oil.

Development was normal, the child sitting up at 4 months, talking at 9 months, teething at 10 months, and walking at 11 months. He started school at six years of age and in spite of subnormal vision kept up with his class.

Past illnesses included chickenpox at the age of 4 years, whooping cough and measles at 9, and mumps at 10 years of age.

Physical examination showed a fairly well-developed and well-nourished white male who was coöperative and alert. The head and neck were normal; the ears were negative for patho-

logic changes, and the nose showed no abnormalities. Examination of the throat showed enlarged but uninfected tonsils. Dental hygiene was good. The thorax was negative, except for prominent scapulae. The heart and lungs were normal. The abdomen, as well as the genitalia and extremities, was normal. The deep reflexes were slightly hypoactive bilaterally. Sensation was normal. The Kahn, Kolmer, and tuberculin tests were negative, and complete blood count and urinalysis gave normal findings.

Subsequent physical and ocular examinations were made in August, 1938, September, 1939, and February, 1940. The visual acuity has not changed, nor has any progress in the pathologic changes in either macula taken place.

The intelligence has remained normal, and the patient is now enrolled in the California School for the Blind to learn handcraft.

*Case 5.* D. T., a white male, was first examined on February 10, 1938, at the age of five years, because of the pathologic changes found in the eyes of his two brothers, described in cases 3 and 4. So far as the mother knew, there were no ocular complaints. The vision in the right eye was 20/40—2 when tested by the illiterate test chart, and in the left eye it was 20/40+1. Refraction under homatropine showed an error of +0.75 D. sph. in each eye, but correction of this error did not improve the vision.

External examination disclosed that the lids were normal; the bulbar and palpebral conjunctivae were normal, and ocular motility was within normal limits. The pupils were large, round, equal in size, and active to both light and convergence. When examined by oblique illumination and the corneal microscope, the cornea of each eye was found to be normal.

Ophthalmoscopic examination showed no pathologic changes in the lenses nor in the vitreous body of either eye. The discs were normal in color, outline, and cupping, and all retinal vessels were normal in color, caliber, and the ratio in size of arterioles to veins.

Under homatropine, each macula was seen to be finely granular or stippled, with minute yellowish areas that reflected the ophthalmoscope light strongly. The area involved in each eye was 0.5 disc diameter in size. There was a lack of pigment in the involved areas, and no migration of pigment was observed. The periphery of each fundus was free from pathologic changes. The ocular changes were identical in the two eyes.

An attempt was made to take the peripheral visual fields, but the age of the patient made this test too uncertain, and the effort to obtain the central fields was no more successful. There was no color blindness.

The patient was seen in the Pediatrics Department, University of California Hospital, on the service of Dr. Mary Olney. There were no complaints either of ocular or of physical discomfort. There was no night blindness.

The family history was noteworthy only because this boy was a brother of the patients described in cases 3 and 4. There was no history of insanity, diabetes, or high blood pressure in the family. The past history showed that the patient was a full-term infant who weighed nine pounds at birth, and that the delivery was normal. He was breast-fed for the first eight months and was given supplementary orange juice. No cod-liver oil was administered. Development was normal, as shown by the fact that the patient walked at 9 months and talked at 10 months. He had measles at the age of three years, and mumps at the age of four years. There had been no other childhood diseases, nor had any operations been performed. The history revealed only an occasional attack of tonsillitis.

The physical examination showed a well-developed and well-nourished intelligent boy, aged five years, who was most coöperative during the examination. There were several verruca plana on the skin of the back of the hands; otherwise the skin tests were negative. The distribution of hair was normal. There was no lymphadenopathy. The head was of normal contour, and the scalp was healthy. The ears and nose were normal, but examination of the throat revealed moderately hypertrophied tonsils. There were no permanent teeth, and the deciduous teeth were carious. The thorax, heart, lungs, and abdomen were normal. The extremities showed no clubbing nor edema. The deep reflexes were all present and normally active; there was no ankle clonus; the Babinski reflex was negative.

Wassermann and tuberculin tests gave negative reactions, and a complete blood count and a urinalysis gave negative findings.

Subsequent ocular and physical examinations were made in August, 1938, September, 1939, and February, 1940. Both physical and mental development has been normal.

*Case 6.* R. R., a white male, aged nine years, was first seen in the eye clinic on July 2, 1932. His parents stated that he had had poor vision since starting school, three years previously, and also that bright light caused ocular discomfort. The vision in the right eye was 20/200 and in the left eye 17/200. There was no improvement in the visual acuity of either eye with correction for compound hyperopic astigmatism after homatropine cycloplegia.

On external examination the lids were found to be normal except for increased spasticity; the palpebral apertures were slightly narrowed and the ocular movements full. There was poor

fixation, but no nystagmus was found. The pupils were round, equal, and active to light and accommodation, the palpebral and bulbar conjunctiva of each eye was normal, and each cornea was negative for pathologic changes when examined by both the corneal microscope and oblique illumination and the loupe.

On ophthalmoscopic examination it was found that the media of each eye were free from pathologic changes. An ophthalmoscopic examination of the fundi made while the pupils were dilated with homatropine showed the discs to be normal in color, outline, and cupping; there was no visible loss of substance. The vessels were normal in caliber, color and arteriolovenous ratio.

The macula of the right eye showed a horizontally oval area, 1½ disc diameters in size, with fairly sharp and distinct borders. The entire area seemed slightly depressed, and the background was of a salmon-pink color that was lighter than the surrounding retina. Scattered over this entire light-colored area were numerous fine dustlike granules of pigment that gave to the whole a stippled appearance. In the periphery of the fundus of the right eye were a few fine spots of pigment that were difficult to see. The fundus of the left eye was similar to the right. No foveal reflex was present in either eye.

Peripheral visual fields were taken on a standard perimeter, using 7 foot-candles of illumination and a 3-mm. white test object at 330 mm. These showed normal peripheral limits for each eye. Central visual fields were measured on the tangent screen, using 10 foot-candles of illumination and white test objects of 2 and 5 mm. at 1,000 mm. The field for the right eye showed normal peripheral limits and a central scotoma of 2 degrees. The field for the left eye showed the peripheral limits to be 12 degrees, with a central scotoma of 3 degrees with each isopter. There was no hemeralopia. The color sense, tested by the Holmgren skein test, was normal.

The patient was seen in the Department of Pediatrics. His only complaints were of "poor vision" and that his "eyes hurt in sunlight." The onset of visual difficulties occurred at the age of six years, although he had made normal progress in school and was alert and coöperative. The family history showed that the mother and father were living and well, and that they had no visual difficulties whatsoever. One brother (case 7) had a similar affection to that of the patient. One paternal uncle had been in an institution for the blind in Illinois during his childhood, with subsequent recovery of some vision. No other pertinent history could be traced in three generations. There was no history of cardiac, glandular, or central-nervous-system disease, nor of tuberculosis or carcinoma. The past history showed that the prenatal period was normal, and that the patient was born at term by a normal delivery. He was breast-fed for the first year, and then put on a general diet. He received little, if any, cod-liver oil or fruit juices. He teethed at 6 months, walked at 1 year, and talked at 18 months. His subsequent growth and development were normal, as was his progress in school. At the age of five years the patient was bitten by a rabid dog and received the Pasteur treatment. He had both chickenpox and whooping cough at the age of six years and mumps at the age of seven years. He had not been vaccinated against smallpox but had received antitoxin for diphtheria at the age of eight years. He had an adenotonsillectomy at the age of seven years.

Physical examination showed a white male, aged nine years, normally developed but somewhat poorly nourished. He was coöperative and seemingly of normal intelligence. The skin and glands were normal, and the ears, nose, and throat showed no pathologic changes. The teeth were in good condition, and the chest and abdomen, as well as the heart and lungs, were normal. The genitalia, extremities, and reflexes were normal. A blood-Wassermann test gave a negative reaction, and a urinalysis showed no abnormal findings.

Subsequent examinations were made on April 9, 1936, and May 25, 1939. These examinations failed to disclose any significant changes in the ocular or mental condition of the patient. He has been enrolled in the California School for the Blind since 1932, and his development and progress have been normal.

*Case 7.* E. K., a white male, aged 10 years, was first seen in the University of California eye clinic on April 9, 1936. He had had poor vision for the four years preceding our first examination, or since beginning school at the age of six years.

The visual acuity in the right eye was 17/200, and in the left eye, 20/200 without correction. Difficulty in reading was the only complaint.

External examination showed that the lids, palpebral and bulbar conjunctivae, and the ocular motility were normal. Fixation was poor, and a muscle-balance was attempted, but abandoned as too inaccurate. The pupils were round, equal, and active to light and accommodation. The corneae showed no pathologic changes when examined by the corneal microscope and the slitlamp. On ophthalmoscopic examination media of each eye were found to be normal.

The pupils were dilated with homatropine, and ophthalmoscopic examination of the fundi showed that the discs were normal in color, outline, and cupping, and that the vessels were normal in caliber, color, and in the ratio of

size of arterioles to veins.

The maculae of the two eyes showed identical changes, so that only one need be described. There was a horizontally oval area, about 1½ disc diameters in size, at the macula, which had slightly irregular, sharply defined borders. The entire area was lighter in color than the surrounding normal retina, and appeared patchy and coarsely granular. Scattered throughout were fine, dustlike particles of brown or black pigment. This area, when viewed with the Gullstrand binocular ophthalmoscope, appeared depressed below the level of the surrounding retina, and had gently sloping borders. When the eye was examined by this method, the loss of substance appeared to be pronounced. The normal foveal reflex was absent.

Color vision, tested by the Holmgren skein test, was found to be normal, and there was no night blindness.

Peripheral visual fields were taken on a standard perimeter, using 7 foot-candles of illumination and a 5-mm. white test object at 350 mm. This test showed normal peripheral limits for each eye, although fixation was not so steady as is normal. Central fields were measured on a tangent screen, using 10 foot-candles of illumination and a 2-mm. white test object at 2,000 mm. This test showed normal peripheral limits for each eye and a central scotoma of 3 degrees.

The patient was seen in the Department of Pediatrics, his only complaint being of poor vision. The onset of poor vision occurred at the age of six years, at which time the patient entered grammar school. Aside from the visual difficulties encountered in the schoolroom, his development was normal.

The family history disclosed that both parents were living and well and free from ocular disorders. One brother (case 6) has the same affection as the patient. One uncle had been in an institution for the blind in Illinois during his childhood. The family history was negative for cardiac, glandular, and central-nervous-system disease, and there was no history of tuberculosis or carcinoma. Consanguinity was denied.

The past history showed that the prenatal period was normal, and that delivery was normal and at term. The patient was breast-fed for 10 months and then received a varied diet of soft foods. No cod-liver oil and no fruit juices were given during infancy. He teethed at 7 months, walked at 14 months, and talked at 18 months. His subsequent growth and development were normal, as was also his progress in school. He had whooping cough at four years of age and chickenpox at five years.

Physical examination showed a white male, aged 10 years, who was normally developed but underweight. He was coöperative and alert and answered questions intelligently. The skin was normal, and there was no adenopathy. The head, neck, nose, and throat were normal; tonsils were present but were not enlarged. The teeth were in poor condition. The heart and lungs were normal. The chest showed fair but equal expansion, and the abdomen was negative for tenderness and palpable masses. The deep reflexes and extremities were normal. A blood-Wassermann test was negative, and a blood count and urinalysis gave normal findings.

Subsequent ocular examinations were made in May, 1939, and June, 1940. These examinations disclosed no changes in the ocular or mental condition of the patient. He is at present assistant librarian in the California School for the Blind in Berkeley, California.

*Case 8.* C. H., a white male, aged 39 years, was first seen in the eye clinic on December 29, 1937. He stated that his vision had been poor for about 20 years, but that the decrease in vision had been so gradual that he did not become alarmed until he found he was unable to see newsprint. This occurred five years before coming to the clinic.

The vision at the time of our first examination was 20/200 in the right eye and 15/200 in the left eye.

On external examination the lids and the palpebral and bulbar conjunctivae were found to be normal, and the pupils were round, equal, and active. The corneae showed no pathologic changes when examined by the slitlamp and corneal microscope, nor by oblique illumination and the loupe. Ocular motility was grossly normal, although there was a marked tendency to eccentric fixation. The muscle balance was not tested.

On ophthalmoscopic examination the media of both eyes were found to be clear, the discs normal in color, outline, and cupping, and the vessels normal in caliber, color, and ratio of arterioles to veins. The periphery of each fundus was entirely normal, but each macula presented important changes that were identical in the two eyes. An area measuring 2 disc diameters in size with sharply defined borders, was seen in each macular area. The foveal reflex was absent bilaterally. The entire area appeared to be coarsely granular and somewhat depressed; it was lighter in color than the surrounding retina, and an irregular depigmentation seemed to be the most striking feature. No pigment clumps were visible.

Peripheral visual fields were taken on a standard perimeter, using 7 foot-candles for illumination and a 3-mm. white test object at 330 mm. This test showed normal peripheral

limits. Central fields were measured on a tangent screen, using 10 foot-candles of illumination and 2-, 3-, and 20-mm. white test objects at 2,000 mm. These fields showed bilateral central scotomata measuring 10 degrees in the right eye and 12 degrees in the left eye. The borders of the scotomata were very steep. There was no hemeralopia, for the patient stated that he saw better when the light was not too bright and that his eyes were more comfortable in winter than in summer. Several attempts were made to photograph the fundus, but the attempts were abandoned because of marked photophobia. When tested by the Holmgren skein test, the patient was found to be color blind.

The patient was seen in the Medical Department of the University of California Hospital on January 25, 1938. The history of the present illness showed that the onset of poor vision occurred about 20 years before our first examination, or when the patient was 19 years old. The vision grew much worse five years before our first examination, or when the patient was 34 years old. For the past five years he has not been able to read ordinary newsprint except with a magnifying glass. A tonsillectomy was done in 1932 because of "rheumatism" in the left hip. He was also told that the operation might help his vision, but this it did not do. In July, 1935, a physician advised a dental consultation, which resulted in the removal of 17 teeth which were said to be in poor condition. In September, 1935, a complete physical examination was undertaken in an effort to find a focus of infection; none was found. The blood-Wassermann test was negative. Next an oculist was consulted, who informed the patient, that he had "loss of central vision," and prescribed potassium iodide drops for oral use. In August, 1936, another oculist made a diagnosis of tobacco-alcohol amblyopia, and the treatment prescribed consisted of pilocarpine sweats, infrared-ray irradiation, sinusoidal treatments, and elimination. Lipiodine tablets and sodium iodide and strychnine tablets were given internally, and a 4-percent dionin solution was prescribed to be used locally. The patient stated that he did not believe that he derived any benefit from any of this treatment.

The family history showed that the patient's mother died of goiter at the age of 46 years, and that his father, aged 83 years, was living but suffering from heart disease. One brother died of sleeping sickness at the age of 35 years. Two brothers and two sisters are living and well. No member of the family, aside from the patient, has had any eye complaints that could not be corrected with lenses. The family history disclosed no tuberculosis, syphilis, hemophilia, or allergic conditions.

During childhood the patient had had measles, mumps, and chickenpox. In 1919 he had had gonorrhea, for which he had received adequate treatment, and no complications had occurred.

Physical examination revealed a well-developed, overweight male, aged 39 years. The skin was soft, warm, and dry, with a few scattered pigmented nevi. The head and neck exhibited no pathologic conditions. The nose and throat were normal. The ears were normal externally, and the tympani were pale and intact. The few remaining teeth were somewhat carious. The heart and lungs were normal; the chest showed full and equal expansion. The abdomen revealed no tenderness nor masses. No organs were palpable. The deep reflexes were normal.

Examination of the visual fields, fundi, and visual acuity had been made on six separate visits until July, 1940. No change had been observed at any time. A complete neurologic examination was made on July 30, 1940, and was negative except for the visual acuity, visual fields, and macular degeneration.

## Summary

The literature on familial macular degeneration is reviewed and comment made on the history of the disease. A description of the lesion is given together with a discussion of the etiology, prognosis, pathologic changes, and differential diagnosis.

The case histories of eight patients having familial macular degeneration are presented. There are six males, and two females. Four families are represented. The parents of all the children were free from any similar eye disease, and in none of the cases was there a history of hereditary disease in the family. Consanguinity in the parents or the grandparents was not disclosed, and in no case was syphilis a causative factor. The ages at onset were as follows: One at the age of 5 years, four at 6 years, one at 7½ years, one at 8 years, and one at 20 years. Thus, in no case was puberty an etiologic factor. The distance vision varied from 20/50 to 20/200, and most of the patients could read large print by holding it close to the eyes. There has been no material change

in the vision or in the appearance of the condition in the past eight years. None of the patients showed any signs of mental deterioration, or any neurologic abnormalities, but, on the contrary, the intelligence quotient was, for the most part, above normal.

The lesions in the eyes presented a fairly characteristic picture. The fundi showed a symmetrically identical localized area of macular degeneration, without much disturbance of the pigment; in some cases there were small white dots scattered about the retina.

The changes in the perimetric fields likewise followed a uniform pattern. There was a central scotoma corresponding to the retinal lesion, the peripheral fields being normal.

Attempts to measure the light sense were unsuccessful because of the poor central vision and faulty fixation, but most of the patients stated that they saw better in a dim light and none admitted night blindness.

All the patients were examined by pediatricians, internists, and psychiatrists, and in no case was there any unusual physical abnormality that bore any relation to the ocular disease. Particular emphasis was placed on endocrine and vitamin studies.

We feel that the number of these cases reported has been sufficiently large to justify a separate classification of this condition among retinal diseases. Furthermore, in our opinion, the disease can appear at any age. The belief that the onset of puberty is a causative factor should be discarded. The fact that seven of these eight cases appeared between the ages of 5 and 8 years, and one at 20 years, would seem to favor the above opinions.

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# THE USE OF RIBOFLAVIN IN THE TREATMENT OF CORNEAL DISEASES*

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The first careful study of the ocular manifestations of a condition that is now recognized as uncomplicated riboflavin deficiency in the rat was reported in 1931 by Day, Langston, and O'Brien,[1] although numerous investigators[2, 2a, 2b, 2c, 2d, 3] had previously referred to the ophthalmia and conjunctivitis seen in "vitamin $B_2$ or G" deficiency. Salmon, Hays, and Guerrant[4] observed an opacity in the eyeball of some of their rats. The data of Day, Langston, and O'Brien[1] were based not only upon gross observation, but also upon studies made with the ophthalmoscope and upon those of histologic section. They reported the following incidence of ocular manifestations in the rats observed: alopecia of the eyelids, 68 percent; lacrimation, 60 percent; conjunctivitis, 96 percent; discharge, 92 percent; thick, swollen, inflamed lids, 92 percent; cataract, 94 percent; and anterior interstitial keratitis, 100 percent. O'Brien[5] in 1932 and Yudkin[6] in 1933 reported experiments confirming these findings. In a study of "vitamin-G" deficiency in the mouse, Langston, Day, and Cosgrove[7] reported finding keratitis in 79 percent, cataract in 96 percent, and ophthalmia in 57 percent of the animals observed. In a long series of papers from the Arkansas laboratories,[8–15] attention was repeatedly called to the ocular manifestations of vitamin-G deficiency: keratitis, vascularity of the cornea, conjunctivitis, and cataract.

In 1937 Day, Darby, and Langston[16] demonstrated that pure riboflavin, natural or synthetic, would prevent the keratitis, cataract, and other ocular manifestations of "vitamin-G" deficiency. The following year the same laboratory[17] reported that the parenteral administration of pure riboflavin to rats with ocular manifestations of riboflavin deficiency resulted in the rapid disappearance of the keratitis, and in many cases the arrest of the cataractous changes. Day and Darby[18] reported in 1938 that severe keratitis was seen in all animals receiving a limited amount (30 micrograms weekly) of pure riboflavin, but cataract was less common in these animals than in animals receiving a diet from which riboflavin was rigidly excluded.

Not all investigators have observed such a high incidence of cataract in riboflavin deficiency as has been observed from this laboratory. Thus Bourne and Pyke,[19] using larger rats, observed cataract in only 20 to 31 percent, but superficial keratitis in 92 to 100 percent. György[20] did not observe any cases of cataract, and he failed to mention having observed keratitis; Bourne[21] reported cataract in only 15 percent; Sen, Das, and Guha[22] found cataract in only 12 percent, whereas Kellogg[23] observed an incidence of cataract in between 60 to 71 percent of animals. Eckardt and Johnson[24] observed cataract in only 2 out of 23 rats which had been placed on a riboflavin-deficient diet, while 12 of the 23 rats developed superficial vascularization of the cornea. They stated: "Keratitis and vascularization of the cornea were more consistent ocular changes than cataract and were improved

* From the School of Medicine, University of Arkansas. Research paper no. 524, Journal Series, University of Arkansas. The authors are indebted to the Department of Medical Research of the Winthrop Chemical Company, and to the Merck Chemical Company for liberal quantities of riboflavin.

by addition of riboflavin to the diet."

In 1939 Bessey and Wolbach[25] reported a very careful histologic study of the vascularization of the cornea of the rat in riboflavin deficiency. In their summary and conclusions they stated: "Vascularization of the cornea of the rat in the absence of antecedent pathology is probably a specific and the most reliable criterion of riboflavin deficiency."

Recent reports on human riboflavin deficiency[26-35] indicate that the ocular manifestations are almost the exact counterpart of the picture that is seen in the eye of the rat with regard to the pathologic alterations in the cornea and related structures. Up to the present time no conclusive evidence has been presented that would show whether any cases of human cataract are the result of riboflavin deficiency. Since cataract apparently develops in rats only when they are subject to riboflavin deprivation at certain periods of growth, it would not be surprising if it were ultimately found that riboflavin deficiency does not induce cataract in the human adult.

In 1939 Pock-Steen[26] reported the ocular symptoms of patients suffering from sprue and related disorders. He found that the administration of riboflavin resulted in improvement of the visual acuity in such patients who had a condition which he termed "twilight blindness." Spies, Bean, and Ashe[27] stated in 1939 that certain of their patients who were suffering from riboflavin deficiency gave a history of visual disturbances. Later in the same year Spies, Vilter, and Ashe[28] reported a syndrome characterized by bulbar conjunctivitis, lacrimation, burning of the eyes, and failing vision which responded to riboflavin therapy. Among the patients of Sydenstricker, Geeslin, Templeton, and Weaver,[29] suffering from riboflavin deficiency, one exhibited conjunctivitis and photophobia, which showed marked improvement under riboflavin therapy. Kruse, Sydenstricker, Sebrell, and Cleckley,[30] in January, 1940, reported findings on nine patients with other symptoms of riboflavin deficiency who developed ocular lesions. "Slitlamp examinations and ocular signs revealed that the principal manifestation was keratitis. The corneal lesions improved or disappeared upon administration of riboflavin and reappeared on cessation of riboflavin therapy." In May, 1940, Johnson and Eckardt[31] reported that of 36 patients with rosacea keratitis, only 4 failed to respond satisfactorily to the oral administration of riboflavin. Sydenstricker and associates[32] stated in June, 1940: "Photophobia, dimness of vision, and actual impairment of visual acuity were promptly, even dramatically, relieved by the administration of riboflavin, in some cases before visual changes occurred in the cornea. Congestion of the sclera, vascularization and opacities of the cornea, and abnormal pigmentation of the iris responded rapidly to the administration of riboflavin." Further effectiveness of riboflavin in the treatment of nutritional keratitis has been presented by Spies and associates[33] and by Sydenstricker.[34, 35] The latter report stated: "At the present time it seems that superficial vascular keratitis is the earliest and most common visible manifestation of riboflavin deficiency as well as a rather reliable index of early deficiency of the B group of vitamins."

## Experimental

Twenty-eight patients with corneal disease have been treated with riboflavin. The results were varied, dependent upon the etiology (table 1). Cases of interstitial keratitis associated with hereditary syphilis responded much more rapidly when riboflavin was administered than when antiluetic treatment alone was given. Two

TABLE 1

SUMMARY OF CASES OF CORNEAL DISEASES TREATED WITH RIBOFLAVIN

| No. | Case | Age-Sex | Diagnosis | Associated Diagnosis | Associated Treatment |
|---|---|---|---|---|---|
| 1 | VK | 5-F | Interstitial keratitis | Congenital syphilis | Bismuth, Mepharsen |
| 2 | RMV | 24-F | Interstitial keratitis | Syphilis | Mepharsen |
| 3 | DM | 13-M | Interstitial keratitis | Congenital syphilis | Bismuth, Mepharsen, Atropine |
| 4 | WB | 26-M | Marginal ulcer | Acquired syphilis | Mepharsen, Bismuth |
| 5 | AMS | 18-F | Interstitial keratitis | Congenital syphilis | Mepharsen, Bismuth, Atropine |
| 6 | MV | 11-F | Keratitis, etiology undetermined | Asthma, Allergic dermatitis | Allergic treatment, Atropine |
| 7 | RI | 9-M | Interstitial keratitis | Congenital syphilis | Mepharsen, Bismuth, Atropine |
| 8 | JWC | 35-F | Keratitis, etiology undetermined | None | Foreign protein, Atropine |
| 9 | FG | 24-M | Keratitis, etiology undetermined | None | 40,000 units vitamin A |
| 10 | OHC | 26-M | Linear keratitis | None | None |
| 11 | SSP | 56-M | Keratitis following corneal ulcer | Focal infection teeth | None |
| 12 | HR | 26-M | Conjunctivitis, keratitis | None | None |
| 13 | TJB | 62-M | Allergic conjunctivitis | Allergy | None |
| 14 | AC | 8-F | Keratitis, etiology undetermined | Chronic tonsilitis | Tonsillectomy |
| 15 | MGB | 42-F | Allergic conjunctivitis | Allergy | None |
| 16 | HWH | 61-F | Keratitis | Senile cataract | None |
| 17 | BA | 27-F | Marginal keratitis | None | Foreign protein |
| 18 | BS | 14-F | Interstitial keratitis, etiology undetermined | None | None |
| 19 | CA | 41-M | Keratitis conjunctivitis | None | Sulfanilamide orally |
| 20 | AMS | 13-F | Keratitis | Chronic tonsils | None |
| 21 | MS | 4-F | Phlyctenular keratoconjunctivitis | Childhood tuberculosis | Atropine |
| 22 | VK | 5-F | Interstitial keratitis | Congenital syphilis | Atropine |
| 23 | AB | 29-M | Ulcerative keratitis | None | Atropine |
| 24 | MB | 47-F | Punctate keratitis | None | None |
| 25 | RT | 3-F | Keratitis, purulent conjunctivitis | Cleft palate | Surgery to palate |
| 26 | ZM | 10-F | Keratitis, angular conjunctivitis | Avitaminosis | Diet of fresh milk and vegetables |
| 27 | AT | 40-F | Keratitis conjunctivitis | Dermatitis | None |
| 28 | ES | 9-M | Phlyctenular keratitis | None | None |

* Light perception only.

cases of phlyctenular keratoconjunctivitis improved rapidly under this therapy. One patient had previously been treated for two months without improvement. Cases of corneal disease in which no definite etiologic factor could be determined were presumed to be possible cases of aribo-flavinosis. Some of these responded mi-

TABLE 1

SUMMARY OF CASES OF CORNEAL DISEASES TREATED WITH RIBOFLAVIN—*Continued*

| Dosage of Riboflavin | Total Riboflavin mg. | Previous Treatment | Vision Before | Vision After | Remarks: | No. |
|---|---|---|---|---|---|---|
| 8 mg. daily | 550 | Atropine | LP* | 20/50 | No improvement in 6 weeks of treatment before giving riboflavin | 1 |
| 8 mg. daily | 650 | Mepharsen, Atropine, Bismuth | 20/200 | 20/40 | 5 months previous treatment for syphilis with no improvement | 2 |
| 8 mg. daily | 350 | Atropine, Bismuth, Mepharsen | 5/200 | 20/40 | 2 months previous treatment without improvement | 3 |
| 15 mg. intramuscularly | 30 | Atropine, Mepharsen, Bismuth | 20/80 | 20/30 | No reaction local or general to intramuscular use. Healed in 6 days | 4 |
| 8 mg. daily | 300 | Atropine | LP | 20/80 | Still under treatment | 5 |
| 8 mg. daily | 850 | Atropine | 1/200 | 20/30 | Milk, eggs, and butter not included in diet because of allergy | 6 |
| 8 mg. daily | 250 | 8 weeks Mepharsen and Bismuth | LP | 5/200 | Slight improvement in 3 months | 7 |
| 8 mg. daily | 400 | None | 20/100 | 20/50 | Diet would indicate riboflavin deficiency | 8 |
| 8 mg. daily | 350 | None | 20/80 | 20/30 | Keratitis recurred when Riboflavin discontinued. Cleared again with treatment | 9 |
| 16 mg. daily | 400 | Foreign protein, Sulfanilamide | 20/60 | 20/60 | No improvement | 10 |
| 8 mg. daily | 550 | Foreign protein, Sulfanilamide | 20/40 | 20/40 | No improvement in vision. Eyes feel better | 11 |
| 16 mg. daily | 300 | Local Sulfanilamide, Foreign protein, Atropine | 20/60 | 20/30 | Marked rapid improvement | 12 |
| 8 mg. daily | 300 | Adrenalin solution | 20/20 | 20/20 | No improvement | 13 |
| 8 mg. daily | 600 | None | LP | 20/70 | Photophobia disappeared, general health improved | 14 |
| 8 mg. daily | 200 | Sulfanilamide, Allergic therapy | 20/30 | 20/30 | No improvement | 15 |
| 8 mg. daily | 600 | KI saturated solution | LP | LP | Keratitis cleared up in 6 weeks, cataracts remained the same | 16 |
| 8 mg. daily | 250 | Calomel, Diet, Sulfanilamide | 20/60 | 20/20 | Photophobia gone in 2 weeks. Cleared up in 4 weeks | 17 |
| 8 mg. daily | 250 | None | 20/70 | 20/40 | Improved | 18 |
| 8 mg. daily | 200 | Sulfanilamide orally and locally | 20/100 | 20/80 | Improved | 19 |
| 8 mg. daily | 300 | None | 20/30 −1 | 20/20 | Recovered | 20 |
| 8 mg. daily | 600 | Atropine, Yellow oxide, Foreign protein | Not possible | | Keratitis receded, circumcorneal injection cleared up | 21 |
| 8 mg. daily | 200 | Atropine, Antiluetic therapy | Not possible | | Marked improvement | 22 |
| 5 mg. intramuscularly every other day | 45 | Atropine, Sulfanilamide | LP | Moving objects | All inflammation subsided in 10 days | 23 |
| 8 mg. daily | 100 | Extraction of teeth | 20/60 | 20/60 | No improvement | 24 |
| 8 mg. daily | 200 | Irrigations | Not possible | | No change | 25 |
| 8 mg. daily | 200 | None | 20/100 | 20/80 | Redness of canthus of eyes remains, cornea improved slightly | 26 |
| 6 mg. daily | 120 | None | 20/40 | 20/30 | Still under treatment, dermatitis has cleared up | 27 |
| 8 mg. daily | 200 | Yellow oxide, Atropine, Diet | 20/200 | 20/30 | Complete recovery in 4 weeks | 28 |

raculously upon the addition of riboflavin to the diet. Recurrences were noted in one case when the vitamin was omitted from the diet. Allergic cases did not respond; the conjunctival irritation and the steaming of the cornea were not greatly affected by the administration of riboflavin. In one case of linear keratitis of obscure etiology there was no improvement; in another, in which the keratitis was associated with

mature cataracts, the keratitis was improved but no change was observed in the cataract or visual acuity. Riboflavin cannot be considered a specific for all types of keratitis, but it seems to facilitate the healing of some corneal lesions (table 1).

## Report of typical cases

*Case 1.* A negro female, aged 5 years, was first seen on February 14, 1940, with diagnosis of interstitial keratitis, hereditary syphilis. She complained of "a skim over her eyes." The parents had noticed nine months before that the child squinted the eyes. They had observed a "whiteness" over the colored part of the eyes and had used some type of drops and salve.

The examination showed marked blepharospasm; the pupils reacted sluggishly. The cornea was opaque throughout, preventing any fundus examination. There was a marked circumcorneal injection, and vascularization of the cornea could be seen under the loupe. Vision was light perception only. The physical examination showed the tonsils were small; there were no infected teeth. All lymphnodes were enlarged. The chest and urine were negative. The Wassermann test was four plus.

The patient was placed on a therapy of 0.5-percent atropine administered locally in the eye, with mepharsen intravenously and bismuth intramuscularly for three months. On May 5, 1940, the ocular condition was unchanged except that there was less vascularization of the cornea. The patient was given 8 mg. riboflavin daily, and when seen on May 27th, her condition was improved. By June 4th the photophobia had disappeared, and there was no circumcorneal injection. When last examined on September 3, 1940, the eyes showed no inflammatory reaction; a few corneal scars were observed under the corneal microscope. Here vision in each eye was 20/30.

*Case 6.* A white female, aged 11 years, was first seen on May 21, 1940. The diagnosis was interstitial keratitis, etiology not determined. The patient complained of an itching skin and inability to see well. She had had the itching on the flexor surface of the legs for several years. Five years ago she had had blurring of the vision of the right eye, which responded to treatment in eight months. For the past eight weeks she had noticed the blurring of vision, with photophobia and lacrimation in both eyes.

On examination there was found to be a marked photophobia and circumcorneal injection. The cornea was cloudy in the right eye, with dense vascularization observable under the slitlamp. Lens and vitreous were clear. The left eye showed some opacity in the stroma of the cornea; otherwise the eye was normal. Vision was: O.D., 1/200; O.S., 20/40. Physical examination showed the chest, negative; Wassermann test, negative. The urine contained no albumin, sugar, nor bacteria.

The patient was placed on 0.5-percent atropine three times per day and riboflavin 8 mg. daily. When examined on June 4, 1940, the circumcorneal injection had disappeared. On June 24th, the photophobia had improved and vision was: O.D., 10/200; O.S., 20/40. On July 15, 1940, her vision was: O.D., 20/70; O.S., 20/30. Two weeks later, on July 30th, her vision had improved to O.D., 20/50; O.S., 20/30. When seen in September, 1940, the right eye showed a few opaque scars of the corneal stroma, no vascularization; vision was 20/40. The left eye showed the same condition; vision was 20/30.

When the patient was seen on November 1, 1940, the eyes were apparently in the same condition as on the last examination. Refraction for glasses: O.D. +1.50 D. sph. $\bigcirc\!\!\!-$ +3.00 D. cyl. ax. 75° = 20/40; O.S. +1.00 D. sph. $\bigcirc\!\!\!-$ +0.25 D. cyl. ax. 90° = 20/30.

When seen on January 1, 1941, there

had been no observable ocular change.

*Case 9.* A white male, aged 24 years, was first seen on March 18, 1940. Diagnosis: Interstitial keratitis, ariboflavinosis. The patient gave a history of having had blurred vision for one month and photophobia. Only home remedies had been used. On examination a slight circumcorneal injection was found. The cornea appeared steamy. Under the corneal microscope many fine opacities were seen in the stroma. A fine vascularization was present. Visual acuity was 20/80 in each eye.

Physical examination revealed no evidence of pathology. The Wassermann test was negative. The urine contained no albumin, sugar, nor bacteria. The patient was treated with quinine bisulphate ointment 2 percent for 12 days, with no change in the findings. Beginning April 1, 1940, 8 mg. of riboflavin was given daily. On April 10th the visual acuity was 20/60 in each eye. There was still some opacity of the cornea, and the riboflavin therapy was continued. The patient was seen on April 21st when visual acuity in each eye was 20/30; a few opacities were observed in the cornea but no vascularization. Treatment was discontinued at this time, but the patient was seen at weekly intervals until June 12, 1940, at which time vision was 20/30 in each eye. The cornea appeared to be normal. The patient was placed on a maintenance dose of 2 mg. of riboflavin daily. He was seen again on June 12, 1941, with a recurrence of all symptoms, having taken no riboflavin for six months. At this time the cornea showed approximately the same findings as on the original examination.

*Case 14.* A white female, aged eight years, was seen at the Children's Hospital on May 18, 1940, with diagnosis of interstitial keratitis, etiology undetermined.

According to her history, the eyes had been sore for five years and she had had many and various kinds of treatment.

The examination revealed marked blepharospasm and circumcorneal injection. The cornea showed fine opacities in coalescent areas in the stroma with fine vascularization. Smears from the eyes yielded no bacteria nor inclusion bodies. Vision was for light only.

Physical examination disclosed chronic tonsillitis. X-ray examination of lungs was negative, the Wassermann test was negative, and the urine contained no albumin nor sugar. Smears from the vagina were negative for intracellular diplococci. Skin tests for tuberculosis were negative.

Tonsillectomy was performed on May 28, 1940, atropine 0.5 percent was instilled in each eye three times daily until June 1, 1940, but there was little change in her condition. She was then placed on 8 mg. riboflavin daily. The eyes improved gradually, the photophobia becoming less severe. By July 11, 1940, she had taken a total of 600 mg. of riboflavin. At this time there was no inflammatory reaction of the eyes, and vision was 20/100 in each eye. She was discharged from the Hospital with instructions as to a high-vitamin diet.

On October 7, 1940, her eyes were examined again, showing no inflammatory reaction, some corneal scars, with vision in each eye 20/70. On May 14, 1941, it was found that in spite of taking 2 mg. of riboflavin daily for the past two months, she had an exacerbation of her symptoms. Findings on this date were similar to the original ones, but not quite so severe. This would seem to indicate that the etiology of her keratitis had not been discovered and was certainly not a riboflavin deficiency.

*Case 23.* A black male, aged 29 years, was first seen on January 3, 1941. The diagnosis was ulcerative keratitis. He complained that following an attack of influenza his left eye had been painful for one week and he had marked lacrimation. On examination the right eye was appar-

ently normal. The left eye had a marked blepharospasm and injection of the conjunctiva. There was a large corneal ulcer in the central portion, which stained with fluorescein. The entire cornea was opaque.

The physical examination showed no pathology except tonsillitis. The Wassermann test and the urine were both negative.

The patient was placed on a therapy of atropine solution, 1 percent instilled in the eye three times daily, and a saturated solution of sulfanilamide locally every hour. This treatment was continued for one month, but yielded very little change in the condition of the cornea. On February 5, 1941, the patient was given intramuscular injections of riboflavin, 5 mg. every other day, with the previous treatment continued. After the third injection, on February 12th, the circumcorneal injection had cleared up, and the ulcerated area did not stain with fluorescein. After nine injections had been given the treatment was changed to oral administration of the riboflavin, 4 mg. daily. The patient was last seen on March 8, 1941. There was corneal scarring, with vision for moving objects only. There was at no time any undesirable local or systemic reaction to the intramuscular injection of riboflavin.

## Summary

In 28 cases, corneal disease has been treated with riboflavin, with varying results. The cases of interstitial keratitis associated with hereditary syphilis responded more rapidly with the administration of riboflavin than when antisyphilitic treatment alone was given.

Various corneal diseases recovered more rapidly under this treatment. Allergic cases and linear keratitis showed no improvement.

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# OPERATION FOR CONGENITAL GLAUCOMA*

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## INTRODUCTION

Congenital glaucoma or hydrophthalmia (infantile glaucoma or buphthalmos) is perhaps the most hopeless and certainly the most pathetic of ocular conditions requiring surgery. The end result, with or without operation, is frequently blindness, and, more often than not, enucleation of one or both eyeballs is required. Almost 7 percent of inmates in the schools for the blind of the United States of America are victims of buphthalmos.[1] If one considers that the incidence of congenital glaucoma among patients with ophthalmic disorders[2] is only 0.01 percent, one realizes that the rate of blindness among those so afflicted is strikingly high.

## OPERATION

The present article is a preliminary report on the results obtained in 17 successive operations for congenital glaucoma by the method of goniotomy or incision of the iridic angle. The approach across the chamber to the angle was first introduced by Vincentiis[3] in 1892, and some successes were reported by him, by Scalinci,[4] and others. The method then fell into disuse. In 1936, the writer first published his method of goniotomy (goniotrabeculotomy),[5, 6, 7] in which the trabeculum is incised under direct and magnified vision by operating under a contact glass specially devised for the purpose. Some good results of this operation in cases of adult glaucoma, in which the obstructing trabeculum was incised and outflow from the chamber into Schlemm's canal was reëstablished, suggested that incision of the angle might be effective in congenital glaucoma for similar reasons, since examination of anatomic specimens indicated that persistent fetal tissue in the angle was an obstructive factor. The operative results have proved most successful in this tragic condition of infancy and childhood. It has been possible to operate early without the complications or dangers of operations used heretofore. Since most of the cases showed a hazy cornea at the time of operation, it was not convenient to operate under the contact glass. That its use is not necessary for success is shown by the results of the operation and by postoperative gonioscopy. In speaking of the operation, the term "goniotomy" rather than "incision of the iridic angle" is used because of its brevity, and because it implies certain characteristics of technique and gonioscopic familiarity with the angle that I feel to be essential.

## OPERATIVE RESULTS

In the present series of 17 operations, tension was normalized by goniotomy in 16 cases; visual function was maintained in 14. Of these three blind eyes, vision was lost in two before they came to operation. In one the operation failed to normalize the pressure and save vision (case 9, left eye). Sight was preserved in the fellow eyes of these three infants, so that they were saved from total blindness. The ages at time of operation varied between eight days and two years. From one to five years have elapsed since the operations were performed. There has been no loss of function nor cosmetic disfigurement following the operation.

* Presented before the Pacific Coast Oto-Ophthalmological Society at Los Angeles, May 28, 1941.

### Mode of action of the operation

*Postoperative gonioscopy* was performed on three patients. It showed that the procedure had been effective in removing the persistent fetal uveal tissue that was obstructing the filtration angle. Since removal of this tissue resulted in normalization of pressure, it must be assumed that Schlemm's canal was present in these cases. There was no sign that either internal cyclodialysis or external filtration had taken place. One may conclude, therefore, that the mode of action of the operation consists in restoring access of the aqueous to Schlemm's canal by removing obstructing fetal tissue. There was also direct gonioscopic evidence of the presence of Schlemm's canal in that portion of the angle from which the obstructing tissue had been removed. This consisted of a pink band which was seen to lie external to the trabeculum in the position of Schlemm's canal in the adult.

### Schlemm's canal in congenital glaucoma

If one can judge by the reduction of pressure that follows removal of the obstructing fetal tissue in those cases which are seen early, it must be assumed that Schlemm's canal is present. This assumption is confirmed by postoperative gonioscopy in the three aforementioned cases, and by the analysis of anatomic examinations of 84 specimens taken from eyes that had not been operated on, as reported by Anderson.[8] He found that Schlemm's canal was present in 75 percent of the earliest specimens. No sign of it was found in more than half of the specimens taken from children over 2½ years of age. He suggests that the canal becomes closed in the later stages as the result of distention of the eyeball and of increased intraocular pressure. The evidence obtained from anatomic specimens thus confirms the reason given on the basis of my gonioscopic examination for the effectiveness of incising the angle in early cases. It shows the importance of early diagnosis for successful operation and explains why the chances of success with this operation may be expected to diminish with the increasing age of the patient.

### Early operation

In order to be effective, the operation must be performed early before obliteration of Schlemm's canal occurs as the result of prolonged pressure and distention of the eyeball. The advantages of early operation are:

(1) Reduction of pressure before it has permanently injured the optic nerve.

(2) Reduction in size of the eye before distention has produced permanent organic changes.

(3) Prevention of amblyopia ex anopsia due to prolonged obstruction of vision.

(4) Prevention of obliteration of Schlemm's canal, which is due to prolonged distention of the eyeball.

(5) Restoration of normal anatomy and development of physiologic function not only in the excretory angle but throughout the eyeball as well during the period of growth.

It appears that it is not necessary to remove the obstructive tissue throughout the whole circumference, but that a "debridement" of part of the circumference (one fourth to one third) is sufficient to permit the pressure-regulating mechanism to assert itself and permanently maintain normal pressure and function.

When permanent obliteration of the canal has taken place, iridencleisis is indicated as also in those cases in which goniotomy, repeated if necessary, proves ineffective.

## Diagnosis

From what has been stated, it is clear that a prompt diagnosis leading to early removal of the obstruction is highly important. It is noteworthy that in all cases there were at some time congestive or decompensatory signs, in the form of a hazy cornea, that led to the diagnosis. In two of the cases it was the sudden appearance of haziness of the cornea around the twelfth week of life that first called the attention of the parents to the abnormality. They had previously only remarked on the baby's beautiful large eyes.

## Obstruction in the angle of the anterior chamber

In all bilateral cases the increased pressure appeared to be the result of obstruction of the angle due to arrested regression of the uveal meshwork.

Unilateral cases, on the other hand, judging from my limited personal experience and from reviewing the literature, appear to be the result of various kinds of congenital anomalies. In one case gonioscopy showed an aberrant reflection of the iris stroma to an insertion at the internal annular ring.

I have observed bilateral glaucoma in older children and young adults in whom the angle appeared to be normal when viewed with the gonioscope. The pressure in these cases is, I believe, due to reduced outflow through the trabeculum[6] (trabecular glaucoma[7]) in the absence of a gonioscopically demonstrable obstruction. Presumably the obstruction is so slight that hypertension does not arise at an early age but occurs very gradually at a later age. Congestive symptoms do not develop because of the very gradual increase of pressure. Such cases, in which hypertension is not developed until later years, are designated "juvenile glaucoma."[9] They appear to represent a transition to the "trabecular glaucoma"[6, 9] of adult life. The same operations are indicated to relieve these cases as are used for the adult form; namely, external filtering and cyclodialysis.

## Case histories

*Case 1* (fig. 1). F. W., a boy aged 14 weeks, was first seen on October 12, 1935. He was an only child. His parents, the father a dentist, the mother a trained nurse, remarked that he had always had beautiful large eyes. One week previously they had noticed, on his awakening, a white film over both eyes, over the left more than over the right. The eyes had been clear and of normal appearance the prevoius evening. Pilocarpine was prescribed, but the left eye remained visibly enlarged and at the end of one week was "bulging." The patient was referred through the courtesy of Dr. George Lachman.

On October 12, 1935, when the child was first brought under my observation, both corneae were hazy, the eyes irritable and photophobic. The left eye was moderately enlarged. Tension to fingers was increased +1 to +2. Pilocarpine had been instilled three times daily. The pupils were 2 mm. wide. Pilocarpine was instilled at three-hour intervals.

On October 19, 1935, the corneae were still hazy, the tension to palpation +2, and the pupils miotic.

On November 1, 1935, the cornea of the right eye was clear and its reflex good. The cornea of the left eye was hazy; the pupils were miotic. Operation was deferred and treatment with miotics continued in the hope of effecting spontaneous arrest of the condition and in view of the dangers of present-day external filtering operations.

On March 17, 1936, because the intraocular pressure of the left eye continued to remain higher than that of the right eye, it was decided to operate. Under ether anesthesia, tension (McLean) was R.E. 50 mm. Hg, L.E. 55 mm. The cornea of the left eye was slightly more hazy than that of the right and was much larger than when last seen. As I had never had occasion to perform goniotomy in congenital glaucoma, *cyclodialysis* was tried first. Following temporary improvement for one week, the eye that had been operated on returned to its previous condition.

On June 8, 1936, under ether anesthesia, tension (McLean) was taken and proved to be R.E. 70 mm. Hg, L.E. 75 mm. After performing a canthotomy the left eye was operated on by *goniotomy*. This was when the patient was eight months old.

On June 15, 1936, the left eye was smaller, the cornea more brilliant and clearer; there was less photophobia; the baby "acted much better."

On June 26, 1936, under ether anesthesia, tension (McLean) was found to be R.E. 70 mm. Hg, L.E. 28 mm. The left eye was the same size as the right eye. In view of the successful outcome of operation on the left eye it was decided to operate on the right eye in a similar manner.

On June 29, 1936, *goniotomy* was performed on the right eye. Convalescence was smooth. The cornea became clear and brilliant. The baby used his vision to direct his grasp of small objects.

On March 11, 1937, glasses were prescribed: R.E. —10.00 D. sph.; L.E. —6.00 D. sph.

From this time up to the present, the tension of both eyes has been about 30 mm. Hg (McLean).

On June 12, 1940, the tension taken with the child under ether was R.E. 30 mm. Hg, L.E. 25 mm.

On March 27, 1941, almost five years after the operation, vision was: R.E. —13.00 D. sph. = 0.4; L.E. —8.00 D. sph. = 10/200.

Ophthalmoscopic examination showed the fundus of the right eye to be normal. The disc of the left eye exhibited some excavation extending to the rim, but the color was normal.

In the course of the last year the left eye began to diverge intermittently for distance. It is noteworthy that the left eye had been exposed to higher pressure and over a longer period of time than the right eye. It had been more distended, and the cornea had taken a longer time to clear. It appears probable, therefore, that because of these impediments to vision at this early age, amblyopia ex anopsia has developed and that this has recently been aggravated by the divergence, which has encouraged suppression. The right eye is at present under an occlusive patch in an attempt to improve the vision of the left eye.

Fig. 1 (O. Barkan). Case 1. The patient had been operated on at the age of 8½ months. The illustration shows him as he appeared five years after the operation.

*Gonioscopy* under ether anesthesia was carried out on September 2, 1936, with a binocular head loupe, and on June 12, 1940, with the corneal microscope. Findings on September 2, 1936, showed that in the right eye, from the 3- to the 5-o'clock position, the root of the iris has been retroplaced, leaving an area of bare sclera anterior to it. There is no sign of a dialysis, nor of a cleft connecting with the suprachoroidal space, nor of external filtration. A correct interpretation of the findings in the angle was not possible at this time due to the low magnification of the head loupe used.

On June 12, 1940, *microgonioscopy* was performed with the binocular microscope mounted on a highly flexible floor stand,[6] using the low-power objectives and ×10 oculars combined with a hand slitlamp.[10] With this method it was apparent that the iris was inserted more anteriorly than usual. This appearance was due to the fact that the angle was filled by gelatinous material interspersed with some strands of iris stroma, such as might be due to failure of regression of the fetal meshwork. In both eyes the incision extended over about one third of the circumference. In the region of the incision, the meshwork was stripped off, exposing the wall of the angle (trabeculum) to the aqueous. In the right eye, the incision was placed about half way between the internal annular ring of Schwalbe and the new insertion of the iris. As a result the iris appeared "retroplaced." In the left eye, the incision skirted the base of the trabeculum. It created a cavernous appearance, suggestive of a cyclodialysis; but examination of this and subsequent cases convinced me there was no communication with the suprachoroidal space. It is noteworthy, however, that in the left eye, in which this appearance is more marked, the pressure was lower. Microgonioscopy in subsequent cases confirmed the impression gained in this case that the effect of the operation depends upon removal of persistent fetal tissue from the excretory angle.

*Case 2* (fig. 2). A. D., a girl aged 23 months, was first seen on May 25, 1937, exhibiting bilateral congenital glaucoma. I am indebted to Dr. F. C. Cordes for the opportunity of seeing this patient and operating on her. The condition had been recognized at the age of three months. Due to the parents' failure to coöperate, and in spite of the efforts of the social-service workers at the University of California Clinic, the child had remained in poor health and had not been presented for operation. Finally, when the child came under the care of a foster parent, the left eye was beyond hope of restoration—greatly enlarged, degenerate, and inflamed. Enucleation of this eye was refused. The right eye was enlarged, the cornea clouded by scars, and the pressure increased +1 to palpation. There was much photophobia. The child suffered from dermatitis and was a poor surgical risk. Vision, right eye, was the ability to detect hand movements.

Fig. 2 (O. Barkan). Case 2. The patient was operated on at the age of two years. The illustration shows the eyes four years after the operation.

On June 21, 1937, *goniotomy* was performed

on the right eye, under ether anesthesia, from the 1- to the 6-o'clock position. The resulting hyphema required 17 days to become absorbed. A bleb that had formed at the point of counter puncture took 12 days to disappear. These occurrences did not take place in subsequent cases. They were probably due to inexperience, to the marked distention of the bulbus, which had taken place by the time the child was 23 months old, and to her poor health.

On July 7, 1937 tension (McLean) under anesthesia was R.E. 14 mm. Hg, L.E. 43 mm.

Fig. 3 (O. Barkan). Case 3. Operation at the age of 12 weeks. The illustration shows the patient three years after the operation.

On November 12, 1937, the cornea of the right eye was brilliant and much clearer. The cornea of the left eye was hazy, +2, and so opaque that the iris could scarcely be seen. Because of lack of coöperation of the parent, the patient was not seen again until April 6, 1939.

On that date tension (McLean) was R.E. 40 mm. Hg, L.E. 50 mm. The corneal diameter was R.E. 12 mm. Hg, L.E. 15 mm. The cornea of the right eye was brilliant. It showed areas of slight opacification, but these were much less dense than before. The cornea of the left eye was degenerate and chalky. Enucleation of the left eye was again urged. The relatively low tension of 50 mm. Hg in the left eye appeared to be due to beginning atrophy and the change of corneal curvature in this greatly distended eyeball.

On May 7, 1941, the left eye was enucleated.

On May 21, 1941, the tension in the right eye appeared to be normal. Miotics are not being used. The cornea of the right eye is clear. The child picks up objects from the floor and counts fingers at a distance of two feet.

Examination of the right eye with the corneal microscope showed a delicate pupillary membrane, some atrophy of the iris, and iridodonesis throughout its peripheral area. These changes appear in part to have preceded the operation and in part to be due to the fact that operation on the degenerate eye was performed too late on an undernourished child. The preoperative vision was retained.

*Case 3* (fig. 3). H. C., a boy aged 12 weeks, was first seen on February 28, 1938. The parents stated that the child had been unable to open his eyes since birth, and that tears flowed constantly from the eyes. Examination showed both corneae to be cloudy; there was marked

photophobia and epiphora, and marked distention of the eyeballs. Tension (McLean) under ether anesthesia was found to measure R.E. 60 mm. Hg, L.E. 64 mm. Pilocarpine 1 percent was prescribed to be administered at three-hour intervals.

On March 12, 1938, the corneal haze was less dense and the child was able to open the eyes intermittently. Tension was R.E. 70 mm. Hg, L.E. 68 mm.

On April 5, 1938, *goniotomy* was performed on the right eye under ether anesthesia. Tension taken before the operation, was R.E. 60 mm. Hg, L.E. 46 mm.

On April 26, 1938, the tension (McLean) was R.E. 33 mm. Hg, L.E. 53 mm. No miotics had been used in the right eye since the operation. Both eyes were kept open, the cornea of the left eye was still hazy.

On April 26, 1938, *goniotomy* was performed on the left eye under ether anesthesia.

On November 16, 1938, the tension (McLean) was R.E. 38 mm. Hg, L.E. 35 mm. Both corneae were brilliant; that of the left eye still showed a small opacity, but there was less photophobia and no epiphora. In the ensuing months, tension of the left eye was occasionally increased to 50 mm. Hg. Because of intercurrent upper respiratory infections, further operation on this eye had to be deferred until five months later.

On April 26, 1939, tension (McLean) under ether anesthesia was R.E. 32 mm. Hg, L.E. 50 mm. (no miotics having been used).

*Goniotomy* was performed on the left eye for the second time. For several weeks following operation, this eye was reduced in size and the cornea was clear. The patient again contracted bronchitis, and the cornea of the left eye became hazy in the afternoons.

On November 15, 1939, tension was R.E. 28 mm. Hg, L.E. 50 mm. *Goniotomy* was performed on the left eye for the third time under ether anesthesia, the incision extending from the 11- to the 7-o'clock position.

On January 29, 1941, the cornea of the right eye was clear and brilliant. Refraction was corrected with a —4.00 D. sph., and there appeared to be good vision in the right eye, for the child could distinguish letters in books and newspapers. The cornea of the left eye was brilliant, but showed some residual areas of opacification. This eye was slightly larger than the right. Both eyes were pale and comfortable. There was apparently no vision in the left eye.

Summary. The excellent operative result on the right eye was immediate and permanent. The left eye required operation three times. Operation was at first delayed because of an intercurrent respiratory infection, then by my absence from the city, during which time the mother refused to submit the child to operations, and after my return the operation was again delayed because of a respiratory infection. The total delay lasted one year. It accounts for the loss of vision in the eye, due to optic atrophy combined with profound amblyopia ex anopsia. The delay also probably accounts in part for the need of repeating the operation, since the chances of success for goniotomy decrease with time and the age of the child. This eye and two others (case 9) were the only ones in which repeated operation was necessary in the total series of 17 eyes.

*Case 4* (fig. 4). H. B., a boy aged seven months, was first seen on June 28, 1939. He was the only child of a university professor. Three months previously, when the child was four months old, the parents had noticed one morning that the cornea of the left eye was hazy. They paid no further attention to it until the haziness was noticed by the pediatrician, three weeks later. A diagnosis of congenital glaucoma was made by Dr. Gordon Smith of Palo Alto, who found on March 25, 1939, that the tension (Schiötz) under ether anesthesia was R.E. 20 mm. Hg, L.E. 90 mm. Prostigmine 2 percent was prescribed for instillation in both eyes at three-hour intervals. The marked haze of the cornea of the left eye and the photophobia continued. After two weeks the left eye appeared to be "bulging." Three months later a similar condition suddenly developed in the right eye, but worse than it had been in the left eye. The cornea showed extreme haziness. Whereas the development of pressure in the left eye had been gradual, in the right eye it was sudden and occurred in spite of the eye being under the influence of 2-percent prostigmine at three-hour intervals. It occurred within a few days, the cornea turning quite "milky." On June 8, 1939, the tension (Schiötz) was R.E. 40 mm. Hg, L.E. 50 mm. The patient was referred for operation through the courtesy of Dr. Gordon Smith.

On June 29, 1939, *goniotomy* was performed on the left eye under ether anesthesia. Instillation of 0.5-percent prostigmine was continued in both eyes.

On August 7, 1939, the tension (McLean) under ether anesthesia was R.E. 50 mm. Hg, L.E. 30 mm. The cornea of the right eye was clear, and there was maximal miosis due to prostigmine having been instilled every three hours. In the left eye the pupil was 3 mm. in size, prostigmine having been instilled in this eye only on alternate days, the last drop having been given 24 hours before.

*Goniotomy* was performed on the right eye with the incision from the 1- to the 5-o'clock position. An occlusive patch was removed after two days, there being prac-

tically no sign of irritation. Convalescence continued to be smooth. Immediately following surgery of either eye, the cornea cleared and photophobia disappeared. The disposition of the child, which formerly had been unhappy with much crying, became cheerful and smiling. Dr. Smith reported tensions (Schiötz), no miotics being used, as follows: On August 14, 1939: R.E. 30 mm. Hg, L.E. 30 mm.; on September 21, 1939, R.E. 20 mm. Hg, L.E. 18 mm.; on November 27, 1939, R.E. 20 mm. Hg, L.E. 20 mm.

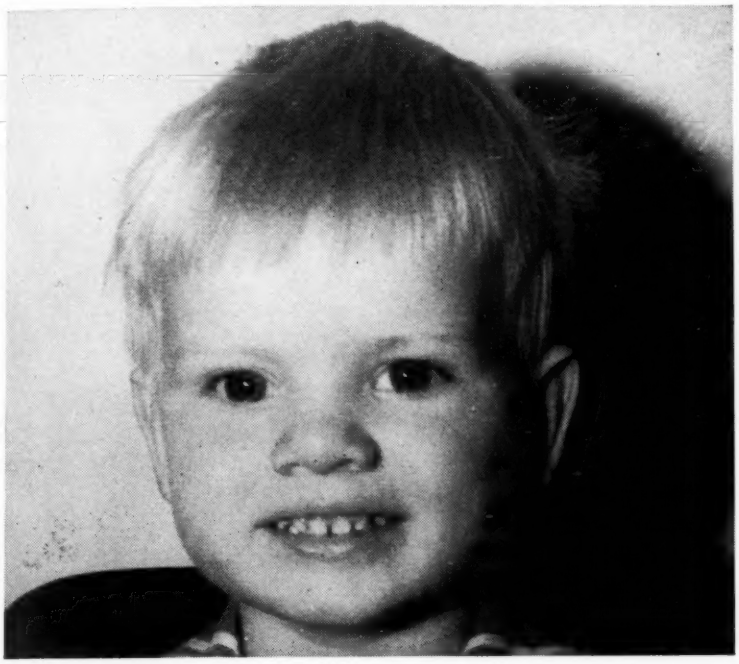

Fig. 4 (O. Barkan). Case 4. The patient was operated on at the age of eight months. The illustration shows him one year and eight months after the operation.

On March 14, 1941, both eyes looked normal except that the left eye was a trifle larger than the right. Tension was normal and vision seemed good. The parents claimed vision to be excellent at home. Gross retinoscopy on the 2½-year-old child indicated: right eye emmetropia or slight myopia, left eye about —4.0 D. sph. myopia. Under prolonged cover the left eye tended to diverge. Objective refraction will be undertaken shortly and glasses prescribed in order to prevent development of amblyopia in the left eye.

*Case 5* (fig. 5). J. R., a boy aged nine months, was first seen on December 7, 1939, through the courtesy of Dr. H. G. Merrill of San Diego. The left eye was considerably enlarged, and the cornea exhibited a milky haze, the pressure to digital palpation being increased +2. The parents had first noticed the haziness and enlargement of the left eye when the baby was three months old.

On December 8, 1939, *goniotomy* was performed on the left eye under ether anesthesia, the incision extending from the 10:30- to the 7:00-o'clock position. The baby was dismissed to his home in San Diego on the fourth postoperative day.

On May 22, 1940, Dr. Merrill reported the tension (Schiötz) taken under ether anesthesia, to be R.E. 19 mm. Hg, L.E. 15 mm. The left eye was under the influence of pilocarpine instilled twice daily. The cornea was entirely clear.

On April 21, 1941, the tension (Schiötz) was R.E. 17 mm. Hg, L.E. 17 mm. No miotics had been used since May, 1940. The baby's health had greatly improved since the operation. He was no longer tired and irritable as formerly. The left eye manifested a slight intermittent esotropia especially for near. The cornea was clear, the eye moderately enlarged, but not so as to be disfiguring on casual observation. There was some vision in

the left eye, demonstrated by the fact that the child grasped at objects when using it alone. Fleeting ophthalmoscopic examination indicated that there was no gross pathologic change. Occlusion of the right eye will now be instituted in order to prevent development of amblyopia in the left eye.

*Case 6* (fig. 6). J. C., a boy aged five months, was first seen on September 6, 1939, through the courtesy of Dr. F. C. Cordes and Dr. G. Campion. The diagnosis of congenital glaucoma of the left eye had been made by the baby's pediatrician, one month previously, when the cornea of the left eye became hazy and photophobia developed. The latter was relieved by the instillation of 2-percent pilocarpine at four-hour intervals, but the corneal haze remained unchanged. During this period the tension (McLean), taken on three occasions, was right eye under 38 mm. Hg, left eye between 55 and 65 mm. The left eye was esotropic 10 degrees.

On January 23, 1940, *goniotomy* was performed on the left eye under ether anesthesia, the incision extending from the 11- to the 6-o'clock position.

On July 10, 1940, the tension (McLean) was R.E. 35 mm. Hg, L.E. 33 mm. The cornea was clear, and the eye appeared to be normal.

On July 31, 1941, the tension to finger palpation was normal and equal in each eye. The cornea was brilliant and, except for the esotropia, the eye appeared to be normal.

Fig. 5 (O. Barkan). Case 5. The patient was operated on at the age of nine months. The illustration shows him one year and five months after the operation.

*Case 7.* L. M., a boy aged 10 weeks, the fourth child of the parents, was admitted to the Children's Hospital from the clinic on March 2, 1940, with the diagnosis of bilateral congenital glaucoma. The Hospital records showed that 0.5-percent eserine instilled at four-hour intervals was not tolerated. A solu-

tion of 0.5 percent eserine and 2-percent pilocarpine, equal parts, twice daily, produced maximal miosis, but the corneae remained hazy and the eyes photophobic, irritable, and distended.

On March 12, 1940, with the eyes under the influence of miotics the Hospital record showed the tension (Schiötz) to be R.E. 35 mm. Hg, L.E. 35 mm.

On March 22, 1940, through the courtesy of Dr. Avery M. Hicks, I was given the opportunity of seeing this child and operating on him. *Goniotomy* was performed on both eyes under ether anesthesia.

On April 7, 1940, the cornea of the right eye was still a little hazy; that of the left eye was clear. The instillation of eserine was discontinued.

On May 3, 1940, the tension (Schiötz) under ether anesthesia was R.E. 20 mm. Hg, L.E. 27 mm.

On June 14, 1940, the tension (Schiötz) under ether anesthesia was R.E. 25 mm. Hg, L.E. 25 mm.

On August 31, 1940, under ether anesthesia, 1-percent eserine had been instilled the previous day, the tension (McLean) was R.E. 46 mm. Hg, L.E. 36 mm. There was maximal miosis; the corneae were brilliant and clear except for a slight nebulous opacity in the upper outer quadrant of the cornea of the right eye, half way between pupil and limbus.

*Goniotomy* was repeated on the right eye after a small canthotomy had been performed; the angle was incised from the 7- to the 3-o'clock position.

*Gonioscopy* (stereomicrogonioscopy) of the right eye was done under ether anesthesia with a hand slitlamp and the corneal microscope mounted on an adjustable portable floor stand.[6,10] It showed but very little effect from the incision in the nasal portion of the angle. In the temporal, unoperated-on portion of the angle, the insertion of the iris into the wall of the angle appeared more anterior than normal, and it was observed to be definitely more anterior than it should have been in consideration of the large size of the eyeball and the stretching of the limbal region. The iris was inserted into the wall by means of delicate stromal arcades. *The spaces between these iris processes appeared to be filled by a thin layer of fetal tissue, which also covered the corneoscleral trabeculum (angle wall).* It is noteworthy that this was observed in the eye with the higher tension in contradistinction to the

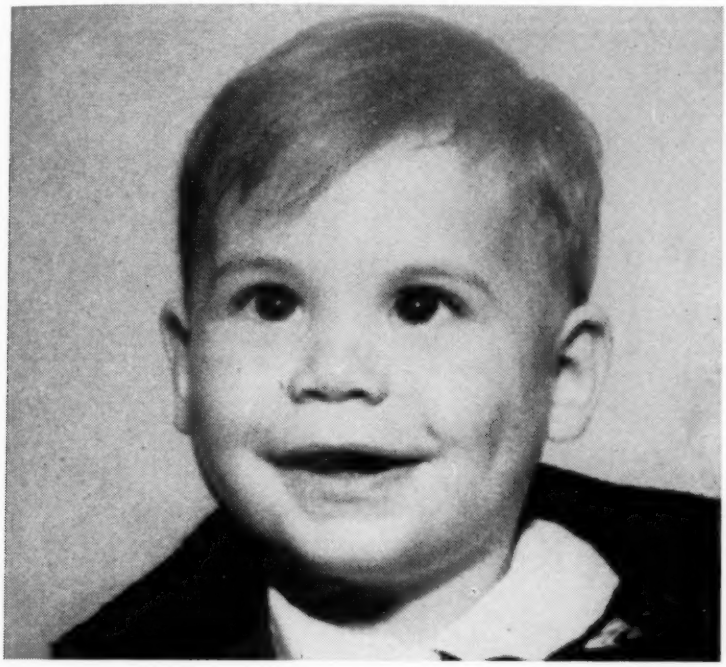

Fig. 6 (O. Barkan). Case 6. The patient was operated on at the age of nine months. The illustration shows him one year and three months later.

left eye in which the gonioscopic appearance was very different; namely,

*Gonioscopy* of the left eye revealed an appearance similar to that described in the right eye in an area from the 6- to the 9-o'clock position. Extending beyond this, from the 9- to the 11-o'clock position, and probably beyond this point (the examination could not be completed around the remaining circumference because of technical difficulties), *the angle wall had been stripped of the uveal meshwork; the insertion of the iris had, as it were, been retroplaced in the region of the incision. In the region where the meshwork had been stripped off, a pink band could be seen running circumferentially around the angle wall in the position that corresponds to that of Schlemm's canal in the adult. Such a pink band, when present in the adult, I believe to be indicative of Schlemm's canal.* The band could also be followed for a millimeter or two from the 9- to the 8-o'clock position before it disappeared completely behind the meshwork. *Apparently, the operation had stripped or pushed back the uveal meshwork from the angle wall, thereby exposing the trabeculum and Schlemm's canal to the aqueous. As no other mechanical effect of the operation was observable, this would seem to be the major factor and probably the only one that produced the reduction in tension.* Dr. Danno, who assisted me in the operation, was able to confirm these microgonioscopic findings in every detail. In view of these findings and of the satisfactory progress and tension in this eye, it was decided to leave well enough alone and to proceed with a repetition of the operation on the right eye.

*Goniotomy* in the right eye was performed after a small canthotomy had been performed. The angle was incised from the 2- to the 5-o'clock position. Due to insufficient illumination, a small iridodialysis occurred, and the anterior chamber became filled with blood. However, the hyphema was absorbed within a few days and convalescence was smooth.

Fig. 7 (O. Barkan). Case 8. The patient was operated on at the age of 15 months. The illustration shows him one year later.

I am obliged to Dr. Bassett of Bakersfield for the most recent report on this child (May, 1941), in which she stated that the eyes and vision appear to be in good condition.

*Case 8* (fig. 7). C. A. S., a boy aged 15 weeks, was the only child of a surgeon in Los Angeles. Shortly after birth the parents and friends had begun to remark on the beauty of the baby's eyes, but regarded it as natural, inasmuch as the mother and her family have large eyes.

On April 12, 1940, on taking up the baby in the morning, the mother noticed that both

eyes were hazy. The right eye was very hazy indeed, a milky white. Drs. Ray and Rodman Irvine of Los Angeles made a diagnosis of bilateral congenital glaucoma, which was confirmed later in the day by Dr. Beigelman. The patient was referred through the courtesy of these doctors and was brought to San Francisco on the following day.

On April 14, 1940, when first seen, the corneae were hazy; the eyes were irritable, photophobic, and enlarged. The sclerae were blue. The pupils were dilated in spite of the intensive use of miotics. Tension to finger palpation was +3.

On April 16, 1940, *bilateral goniotomy* was performed under ether anesthesia.

On April 23, 1940, both eyes were well opened. There was practically no irritation.

The mother stated that she now realized that since birth she had never really seen the color of the eyes, but had thought they were a steel gray. They are now quite blue, although the right eye is not quite so blue as the left. The corneal reflexes are brilliant.

Tension (McLean), under ether anesthesia, was recorded as follows:

| Date | R.E. mm. Hg | L.E. mm. Hg |
|---|---|---|
| April 30, 1940 | 38 | 39 |
| | (no miotics being used) | |
| May 13, 1940 | 36 | 35 |
| June 11, 1940 | 29 | 25 |
| October 25, 1940 | 27 | 20 |

*Gonioscopy* (microgonioscopy) of both eyes was carried out on June 11, 1940.

Right Eye. In the region not operated on the *wall of the angle (corneoscleral trabeculum) appeared as if covered by an optically semipermeable jellylike tissue that was in marked contrast to the bright light-reflecting surface of the area where the incision had been made. The angle appeared to be filled by fetal adventitious tissue, except in the area of operation where it had been removed.* This area extended from the 1- to the 5-o'clock position. From the 1- to the 3-o'clock position, it was bare and appeared white like scleral tissue. From the 3- to 5-o'clock position, a very thin membrane with a few small vessels was observed to extend from the anterior surface of the iris to the scar of the incision in the angle wall without interfering with the effect of the operation. Between the two areas there was a small region, about 0.5 mm. in extent, that had the appearance of a cyclodialysis cleft, but the appearance as a whole and the evidence in this and the other cases did not suggest that an "internal cyclodialysis" had taken place or was an effective factor in the action of the operation. There was no sign of external filtration in this or any of the other cases. The *modus operandi seems to have been the removal of fetal tissue which filled the angle and obstructed the trabeculum.*

This baby was demonstrated by Dr. Ray Irvine in opening the discussion of the present paper at the meeting of the Pacific Coast Oto-Ophthalmologic Society in Los Angeles, in May, 1941. According to the last report received from the parents one month ago, the condition continues to be excellent with "acute vision in either eye."

*Case 9* (figs. 8 and 9). P. N. D., a boy, showed hazy corneae, hard and enlarged eyes at birth. The diagnosis of binocular congenital glaucoma was made by Dr. Robert Steele Irvine, to whom I am indebted for the opportunity of seeing this baby and operating on him.

On August 31, 1940, in the evening, when first seen, the baby was nine days old. The corneae were steamy; the pupils were dilated, not having responded at all to miotics. The bulbi were hard, +3 to digital palpation, and seemed to fill the orbits.

On the morning of September 1, 1940, *goniotomy* was performed on both eyes under ether anesthesia. In the right eye a fairly extensive incision of the angle was accomplished. A small iridodialysis occurred at the point of perforation. The bulbus was markedly reduced in size immediately after the operation, and the cornea was much clearer. In operating on the left eye technical difficulties were encountered, which necessitated interrupting the operation before the angle was incised, but no harm was done.

On September 2 and 3, 1940, the corneae appeared clearer, so that the iris could be seen more distinctly. There was difficulty in obtaining any miosis, however.

On September 12, 1940, under local anesthesia with pontocaine drops, the tension (McLean) was R.E. 50 mm. Hg, L.E. 55 mm.

On September 19, 1940, under ether anesthesia, the pupils were 2½ mm. in diameter. Both corneae appeared slightly less hazy, and the bulbi less large than when originally observed.

*Goniotomy* was performed for the second time on both eyes. The operation on the left eye was again attended with considerable technical difficulty.

On October 3, 1940, under ether anesthesia, the tension (Schiötz) was R.E. 22 mm. Hg, L.E. 42 mm. The cornea of the right eye was clearer and the bulbus smaller; the left eye remained unchanged.

*Iridencleisis* was performed on the left eye with the use of the keratome.

On October 14, 1940, the tension (McLean) was R.E. 35 mm. Hg, L.E. 42 mm., the right eye still being under the influence of eserine.

Reëxamination was deferred because of respiratory trouble.

On December 12, 1940, the tension (McLean) was R.E. 20 mm. Hg, L.E. 80 mm. No miotics had been instilled in the right eye for the last eight days. The cornea of the right eye was brilliant and clear, that of the left eye was gray and stippled. The corneal diameter was right eye 12 mm., left eye 14 mm.

On January 10, 1941, the tension (McLean) was R.E. 35 mm. Hg, L.E. 70 mm. The left eye was enlarged, its cornea hazy.

On January 23, 1941, *Gonioscopy* was performed on the right eye, first with the Hardy head loupe, then with the binocular corneal microscope on my adjustable floor stand (microgonioscopy), under ether anesthesia. As in the other cases of congenital glaucoma in which the eyes were examined microgonioscopically the *iris was seen to be inserted into the internal annular ring of Schwalbe, the angle being filled by a gelatinous-looking material. In the area of operation, between the 10- and the 6-o'clock position, this tissue had been removed,* or, in other words, the abnormally anterior insertion of the iris had been retroplaced, thus exposing the trabecular wall of the angle to aqueous fluid.

On the same date *goniotomy* of the left eye was repeated; this time no technical difficulty was encountered.

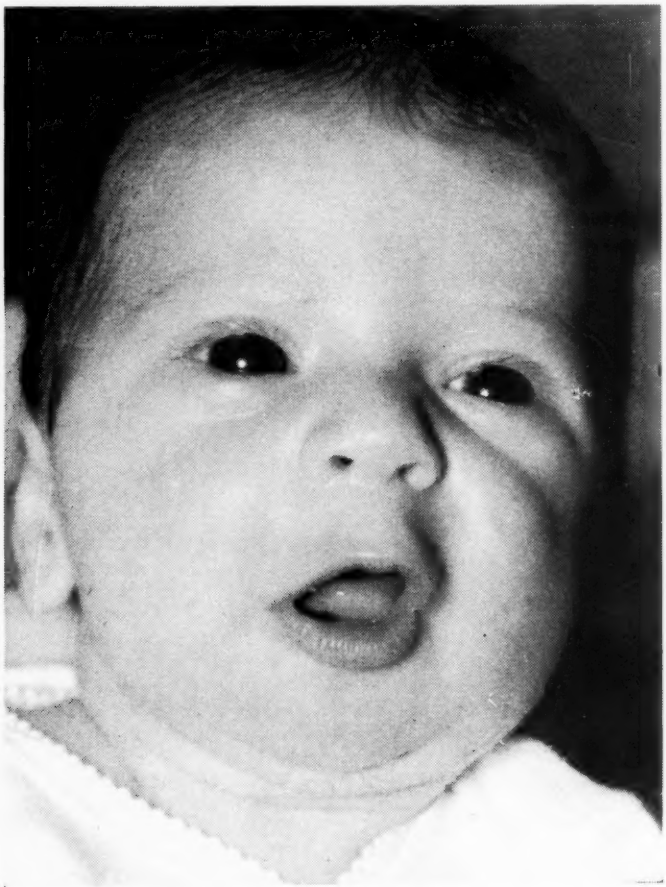

Fig. 8 (O. Barkan). Case 9. The right eye was operated on for the first time when the patient was nine days old. The illustration shows the patient before the second operation on this eye and the first on the left eye at the age of 28 days. Note the corneal haze and enlargement of both eyes in comparison with the condition in the next figure, showing the patient after the operation.

On February 6, 1941, the baby could apparently see well with the right eye, grasping small objects. Tension (McLean) was R.E. 36 mm. Hg, L.E. 60 mm. The left eye was much smaller than before; its cornea was still hazy but clear enough to permit the design of the iris to be seen in detail.

On March 12, 1941, the baby was acting much better, both eyes were brilliant; the left eye was smaller.

On May 20, 1941, the cornea of the right eye looked normal; that of the left eye improved.

On June 2, 1941, the right eye looked normal in size and brilliance. The left eye was

somewhat enlarged and the cornea slightly "milky" so that the iris appeared to be less brown than that of the other eye. Repeated *iridencleisis* was suggested on this eye. This has not been performed to date (July, 1941), due to a respiratory infection.

This is a case of congenital glaucoma in the acute congestive phase at birth. Goniotomy was successful in normalizing tension and preserving vision in the right eye. In the left eye pressure is still increased in spite of two goniotomies and one iridencleisis. The first goniotomy was interrupted because of technical difficulties. The prolonged delay in reoperating was due to intercurrent respiratory infections and lack of understanding on the part of foreign-born parents.

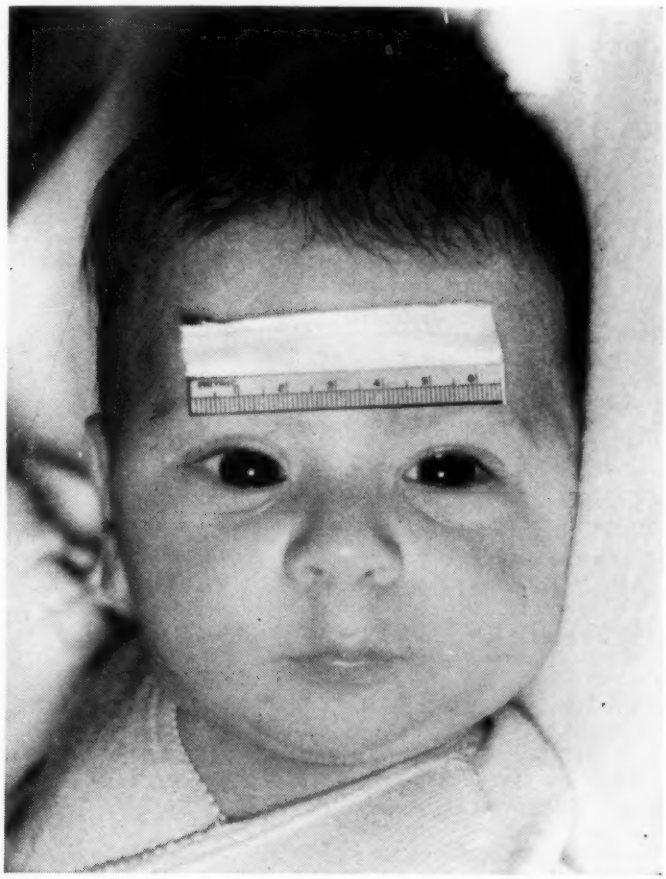

Fig. 9 (O. Barkan). Case 9. The same patient as in figure 8. The right eye was operated on when he was nine days old and both eyes when he was 28 days old. The illustration shows the patient two months after the operation. Note the clear, brilliant cornea and the smaller eyeballs.

*Case 10* (figs. 10 and 11). J. A., a boy aged six months, was first seen on August 30, 1940. Pilocarpine 2 percent had been prescribed at two clinics and at the City Hospital, but the drops had been used only sporadically, the mother being quite unreliable. Both eyes were enlarged, the corneae clear, the pupils measured 4 mm. in diameter, and the tension to finger palpation was +2. Prostigmine 2 percent was instilled into both eyes at three-hour intervals. I am indebted to Dr. Robert Steele Irvine for referring this case.

On September 3, 1940, tension (McLean) under ether anesthesia and under the influence of miotics, was R.E. 48 mm. Hg, L.E. 33 mm. *Preoperative gonioscopy* (microgonioscopy) with a hand slitlamp and the corneal microscope mounted on an adjustable floor stand was performed on the right eye. *It showed the angle filled with a gelatinous-looking material on the surface of which were a few delicate filaments of iris stroma, such as are characteristic of the uveal meshwork.* In other words, the iris processes and the insertion of the iris itself appeared to be in the usual position, but the *potential spaces between them and the wall*

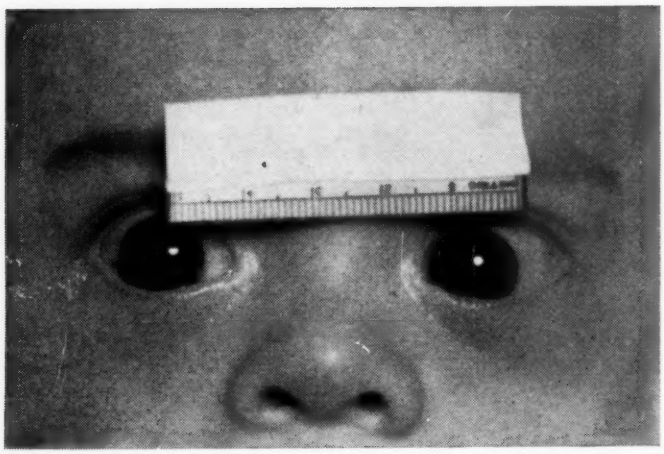

Fig. 10 (O. Barkan). Case 10. The patient was operated on when he was seven months old. The illustration shows the eyes two months after the operation.

*of the angle (trabeculum) were filled by a jelly-like substance which corresponded in position and appearance to the persistent fetal mesoblastic tissue that is seen in anatomic sections of eyes with congenital glaucoma. This tissue evidently obstructed outflow into Schlemm's canal.*

On September 3, 1940, *goniotomy* was performed on both eyes, under ether anesthesia, over a little more than one fourth of the circumference.

On September 10, 1940, tension (Schiötz) was R.E. 10 mm. Hg, L.E. 17 mm.

On September 12, 1940, the eyes looked as

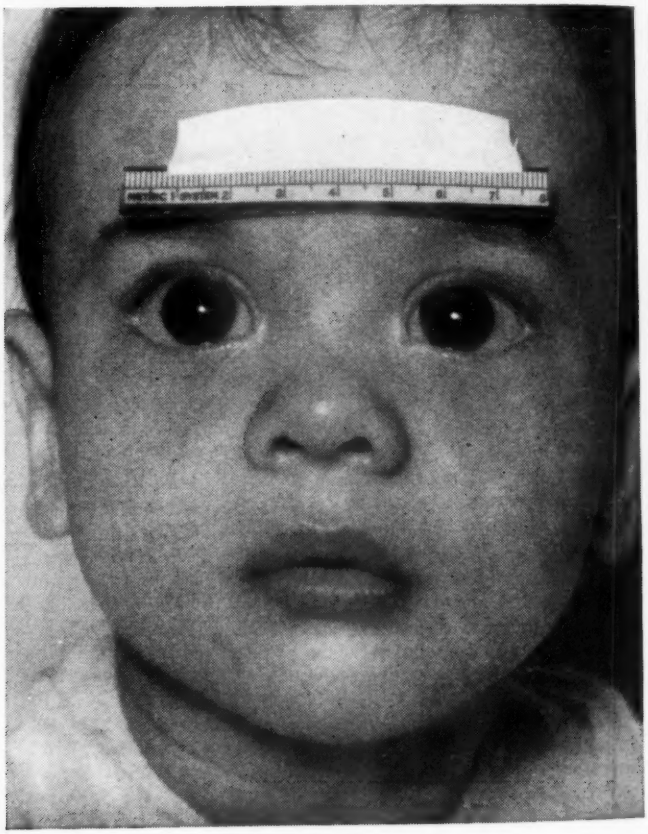

Fig. 11 (O. Barkan). Case 10. The patient was operated on at the age of seven months; this illustration shows him seven months after the operation.

if they had not been touched. The pupils were 4 mm. in diameter, for, due to lack of cooperation on the part of the mother, pilocarpine had not been instilled as it should have been for the first few weeks postoperatively.

On October 8, 1940, the tension (McLean) was R.E. 30 mm. Hg, L.E. 35 mm. without the use of miotics. Both eyes were smaller than they had been but were still larger than normal. The corneae were clear and brilliant—the pupils were 5.0 mm. wide. There was no photophobia. The patient could see small objects and appeared to have useful vision in both eyes.

On April 8, 1941, tension (McLean) was R.E. 29 mm. Hg, L.E. 30 mm., no miotics having been used. Except for their slightly increased size, the eyes looked normal in every respect. Retinoscopy without mydriatics indicated approximate emmetropia. The mother states he "sees everything." To judge by the baby's actions his vision seemed to be acute.

## Conclusions

In this paper the results of operations on 17 eyes with congenital glaucoma are reported. Pressure was normalized in 16 of the 17 eyes; visual function was maintained in 14. Of the three blind eyes brought to operation, vision was lost in two before surgery was instituted. In only one case did operation fail to normalize the pressure in time to save vision. Sight was preserved in the fellow eyes of these three infants so that they were saved from blindness. The average age at time of operation was three months. From one to five years have elapsed since the operations were performed. On the basis of the successful results and of pre- and postoperative gonioscopy, certain conclusions are arrived at in regard to the underlying pathology and to the mode of action of the operation. It appears that the majority, if not all, binocular cases of congenital glaucoma are due to a developmental obstruction in the excretory angle which, when removed, permits outflow of aqueous into the canal of Schlemm. The canal is found to be present and ready to function in the large majority of cases in which the diagnosis is made at a sufficiently early age, before prolonged distention of the eyeball has obliterated the canal. Early diagnosis and early operation are therefore urgently indicated. The operation gives a high promise of permanent success with a remarkable degree of safety and without disfigurement.

*490 Post Street.*

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## Discussion

Dr. A. R. Irvine (Los Angeles, California): Gentlemen, I think one of the most serious and disturbing of all ocular conditions ever to confront an oculist has been that of congenital glaucoma.

In my discussion I simply want to show

you a baby that I was called to see when it was 14 weeks old. This was the first baby in the family. When the mother awakened at six o'clock one morning to take care of the baby, she saw the baby's eyes were white with a film over them. At seven o'clock she called me. When I saw the baby, the cornea was so cloudy you could not see the marking of the iris. He had large corneas, measuring between 15 or 16 mm. across, a deep anterior chamber, and dilated pupils. The eyes were as hard as rocks.

You can imagine how you would feel if you were confronted with such a condition. I told the father that it was a congenital glaucoma and that the outlook was bad. Dr. Beigelman saw the patient in consultation and suggested that surgical procedure would be necessary. We called Dr. Otto Barkan on the telephone that night to see what experience he had had with congenital glaucoma. He told me he had had eight or nine cases. The parents and baby took a plane immediately for San Francisco, and the child was operated on the following day.

This baby is now 17 months old (case 8). He can walk, he can run, and he can see everything there is to see. He has perfectly normal, active pupils.

Dr. H. G. Merrill (San Diego, California): The nine-months-old boy on whom Dr. Otto Barkan operated for me had a tension of 60 mm. Hg (Schiötz). Immediately after the operation the tension dropped to 30 mm., and it is worth noting that it stayed between 25 and 30 mm. for three or four months, during which time we used pilocarpine. Finally it dropped to 18 mm. and has remained there without medicine for the past year and a half. We must always suspect congenital glaucoma when any haziness of the cornea is noted in an infant.

Dr. Irvine: Just how difficult is it to do the operation? Do you do it under direct observation with a contact glass? When you put in your instruments to open the angle, how do you keep the angle from closing as the iris comes forward and gets in the way of your field of operation?

Dr. Barkan (closing): In answer to Dr. Irvine's question, practically all of the operations were performed without the contact glass. It really comes right down to a straight incision of the iridic angle. It has been done quite satisfactorily as you can see from the results. Familiarity with the angle and with goniotomy and the surgical contact glass in adults helps one to know where and how to proceed in the case of these babies.

In regard to the iris coming forward, one must guard against losing the anterior chamber. This is not difficult, for the wound of entry is closed by the shaft of the knife. It is important to traverse the optic axis of the eye. Originally I made the puncture at the horizontal meridian, went across the chamber in an upward direction and, using the point of puncture as a fulcrum, came around. But in so doing the arc that is made with the tip of the knife is less than that of the limbus, so that the tip of the knife tends to become disengaged and one loses contact with the limbus. On the other hand, if in the left eye one makes the puncture at the 4- or 5-o'clock position, proceeds upward across the pupil, and then comes around to make the circle, the natural tendency is for the blade to remain engaged in the angle wall and thus to complete the incision. No aqueous will escape until the incision is completed, and the iris does not come forward.

I wish to thank my colleagues for their interest, helpfulness, and coöperation.

# THE HISTORY OF ORTHOPTICS*

MAYNARD C. WHEELER, M.D.
*New York*

In presenting this review of the historical background of orthoptics, little claim is made as to originality. Much of it is familiar material from standard texts, but, as far as could be determined, never fully assembled before. It should be of some value to those of us who have been interested in orthoptics to try to trace the origin and development of some of our ideas and methods.

Strabismus was recognized by the ancients but the condition was thought to be a permanent deformity, so no treatment was suggested. In the seventh century, Paulus Aeginta, a Greek physician, advised the use of a mask with small perforations over each eye to correct strabismus. Ambroise Paré, the father of modern surgery, advocated the same scheme in 1509, as did Bartisch, the founder of German ophthalmology, living during the last two thirds of the sixteenth century. In 1707, Maitre-Jan, a French surgeon, writing on the subject of squint, made no suggestion as to its treatment. Shortly thereafter, de la Hire, a French ophthalmologist, described squint as arising from a defect of the retina, the eye deviating because the most sensitive portion of the retina was not on the optic axis. This is the first suggestion that has been found that squint could be caused by something other than a muscular defect, although it could be easily proved to be fallacious by covering the fixating eye. In 1743, Buffon, a French scientist, was the first to recommend covering the good eye to force the use of the squinting eye to improve vision. He advised glasses in certain conditions, not clearly designated. Buffon was the second to veer away from the muscular-defect theory, with his belief that squint was caused by the inequality of force of the two eyes. The squint put the weak eye where it could do no harm. In 1801, the English scientist and physician, Erasmus Darwin, advocated reducing the vision of the better eye to equal the other, or occluding the fixating eye completely. This is the first mention of this important form of therapy. A little later, Mackenzie taught that one should look for the cause of strabismus in the brain and the nerves, the organs which preside over the association.

It is of interest, in retrospect, to note that Wheatstone's invention of the stereoscope in 1838, using two mirrors, almost coincided with the first sound attempt to treat squint surgically, by Dieffenbach in 1839. The "massacre of oculomotor muscles" (Javal), which followed the latter, and the bad results obtained, served as an impetus to Javal to utilize the stereoscope in the treatment of squint. In 1849, Brewster constructed the refracting stereoscope, using decentered convex lenses. While Javal is frequently given credit for originating the idea of using the stereoscope, in that he treated his younger sister who had squint, in 1863, we find the following suggestion in Mackenzie's outstanding textbook, published in 1855: ". . . frequently looking into a stereoscope and endeavoring to bring the two images to coalesce, so as to see the object single and as if it stood forward in relief is an exercise likely to be useful in divergence." Equalizing the vision of the two eyes and part-time

*Read before the Joint Meeting of Ophthalmologists and Orthoptic Technicians, at Chicago, October 20, 1941.

occlusion were then accepted practices. Mackenzie placed prisms with base away from the deviation to produce a diplopia which the patient would make an effort to overcome. Yet he also advised spectacles with limited openings that could be gradually brought straight, and a pair of blinders projecting from the temple to attract the eyes outward.

In 1861, von Graefe held exclusively to the muscle theory. While he and others had hinted at it, it was Donders who, in 1864, showed the relation between accommodation and convergence and its role in strabismus. This explanation was readily accepted. Ten years later, the standard textbooks gave full refractive correction as the first step in the treatment.

Krenchel, in 1873, was the first to pronounce "innervation of convergence" and oppose it to the muscle theory. Three years later, Hansen Grut, the Danish ophthalmologist, described strabismus as an active shortening of the muscles equally in two eyes and accomplished by augmentation of the innervation of convergence.

Regardless of who first utilized the stereoscope in the treatment of strabismus, there is no doubt that Javal, the eminent Parisian ophthalmologist, deserves the credit for being the one to establish its use for this purpose, and for showing that binocular single vision is often recoverable by means of exercises with it. In 1864 he read a paper before the Heidelberg Congress describing this new method of treating strabismus, and for the next few years he was an enthusiastic advocate. However, by the time he published his well-known volume "Strabisme," in 1896, his ardor had cooled appreciably, and at the end of the book he concludes that experience had taught him that von Graefe was right when he said that people are not worth so much trouble. At first Javal used the stereoscope exclusively in treating squint. This was partly a reaction to the bad results that were being obtained from the surgical treatment: tenotomies without asepsis or anesthesia. By 1896 he looked upon operation not as the last resort but as a valuable means for shortening the course of treatment. He favored early operation, even under two years of age, rather than waiting until the child would be old enough for exercises. His routine was: measurement of refraction; production of diplopia; fusion of the double images by means of the stereoscope; extension of binocular vision (developing duction); regularization of accommodation. He recognized "false projection" as crossed diplopia after operation, which was undoubtedly the same thing that we now call "abnormal retinal correspondence." As would be expected, because of the inadequacy of his equipment, he rarely detected it before operation. For high degrees of squint he devised a hinged stereoscope with a mirror. All are familiar with his stereoscopic charts, which have been partially reproduced in the Wells series.

In the first edition of de Schweinitz's textbook, published in 1892, we find the first recognition of Javal's work that I have found in English. Inspired by Javal, Priestley Smith took up the educative treatment of squint in 1896, and, as would be expected, contributed an instrument of fundamental importance in his fusion tubes, later improved as the "heteroscope." This was undoubtedly the forerunner of Worth's amblyoscope. Smith pointed out the inadequacy of the accommodation theory and saw convergent strabismus as a disorder of innervation, due to faulty development, in which the visual centers fail to control acts of convergence. The convergence became excessive because it was uncontrolled. He used exercises as an adjunct to glasses and operation, urging early treatment.

Hansell and Reber (1899) believed that binocular vision once lost could not be restored. They held that exercises were of value in low exotropias but not helpful in esotropia. Savage (1902) advocated prismatic exercises for phorias but made no mention of exercises for tropias.

Parinaud, another celebrated Parisian ophthalmologist, has been said to have been the first to comprehend the entire nervous relation of squint. He pointed out that one must recognize two kinds of associated movements: those of direction and those of convergence; and also showed the interdependence of the innervation of these two. He considered it an error to see in strabismus only a disturbance of the innervation of convergence, and made an appeal for the broader view that strabismus is a fault of development of the apparatus of binocular vision with bearing on both the motor and sensory aspects. The motor portion he believed to be convergence. The immediate cause of the deviation, he asserted, was always a disturbance of the innervation of convergence. All of the causes of squint act on convergence by two intermediaries: (a) retinal reflex of convergence—that is, fusion—and (b) accommodation. They have the common character of being an obstacle to binocular vision. They act more efficiently in younger individuals because binocular vision is less developed. The excess of innervation tends to disappear as the apparatus of binocular vision is altered. This may lead to a spontaneous cure, or it may persist due to retraction of the peri-ocular tissue. The sensory portion becomes altered at the same time. Whenever innervation of convergence is weakened, the eyes tend to diverge because of the position of the orbits. Parinaud believed that the "artificial solicitation of binocular vision" could be accomplished by the use of the stereoscope. He used exercises to consolidate binocular vision. It is both surprising and significant that he failed to recognize suppression.

Parinaud prepared the way for Worth's presentation of the fusion theory in 1903. Worth classified binocular vision in three grades: (1) simultaneous macular perception, (2) true fusion with some amplitude, and (3) stereopsis. This classification has become standard in this country. Worth believed that a defect in the fusion faculty is the fundamental cause of squint and based his treatment on this belief. The amblyoscope, which he devised, was by far the best instrument for training fusion that had been brought out, because of its adaptability to high degrees of squint. This instrument, later modified by Black in the addition of a vertical adjustment, is still in wide use and is the fundamental model from which the newer instruments have been derived. Worth established a program for the treatment of squint which has dominated this field for over 30 years. His objectives were: (1) to prevent deterioration of vision; (2) to remove the fundamental cause by training fusion; and (3) to restore the visual axes. He corrected the refractive error; restored vision of the amblyopic eye by occlusion and atropine; overcame suppression, and trained the fusion sense, using the amblyoscope; and finally resorted to operation. In the last edition of his widely read book, published in 1921, he admits that the concept of fusion training was practical in fewer cases than he had thought at first, that the child must be under six years of age, and that fusion training would correct the deviation in only small degrees. However, he held to his belief that the essential cause of squint was defective fusion sense. He also devised the 4-dot test.

After this period of intense activity, guided by such brilliant minds as Javal,

Parinaud, and Worth, it is rather difficult to understand why the nonsurgical treatment of squint failed to make steady progress. Instead, it crept along on the impetus given by Worth, without producing any important innovations, up to what we may call "the modern period"; a space of about 25 years. One reason for this may be Worth's insistence that a defective fusion faculty is the underlying cause of squint in all cases. More important still are the limitations of the amblyoscope. Of these by far the most important is the inability to detect and measure abnormal retinal correspondence with certainty. Apparently Worth was unaware of this; consequently a large percentage of his cases failed to improve.

Modern orthoptics in France really date back to Remy, who, in 1901, devised the diploscope for the reëducation of the strabismic eye, and described its use in a little book of the same name that in 1932 was reprinted in full by Cantonnet in his book "Le strabisme." Following Javal and Parinaud, Remy emphasized the French conception of reëducation and devoted much time and energy to this work, for 24 years making weekly trips to Professor de Lapersonne's clinic at the Hotel-Dieu, in Paris, for this purpose.

Cantonnet adopted Remy's ideas, and, according to his own words, he continued and enlarged on Remy's methods. Cantonnet outlines his own contributions in the introduction to his book: the binocular test based on the "hole in the hand experiment"; adaptation of the "pigeon stereoscope"; application of reëducation to "convalescent cases of ocular paralysis"; the description and cure for "binocular instability"; the "denaturalization by bright light"; the general use of "anaglyphes"; and finally the practice of mental effort, which allows those who are capable of doing so to converge or diverge at will, a rapid and psychologic treatment for strabismus. Filliozat collaborated with him in his book and has been an ardent supporter.

Except for those in England and France, no record has been found in the literature of an orthoptic clinic in the rest of Europe. All are familiar with Sattler's method of treating strabismus by having the children wear strong prisms. His stereoscopic cards offer a wide variety and are particularly valuable in the study of stereopsis. The excellent sets of cards by Hegg and Kroll also deserve mention.

Ettles introduced the synoptophore in England, in 1914. This was developed by Clement Clarke and later modified by Curry and Paxton and called a synoptoscope. These instruments were direct developments from the amblyoscope and are called major amblyoscopes. They opened new vistas and established a sound basis for the treatment of squint because of their precision, adjustability, flexibility, and illumination, to mention only a few advantages. It was not until 1933 that Hamblin brought out the orthoptoscope, designed by Miss Pugh and embodying the same principles.

In 1919 Miss M. C. Maddox, under the inspiration of her famous father, Dr. E. E. Maddox, took up orthoptic work, and 11 years later founded the first orthoptic clinic in England, at the Royal Westminster Ophthalmic Hospital in London. Similar clinics were soon organized in other eye hospitals in England.

The British Orthoptic Board was formed in 1933 to protect patients by regulating the training and qualifications of the orthoptists. Candidates had to have "school certificate or matriculation standards education" and had to study for a year in an orthoptic clinic of one of the hospitals organized by the Board, and they had to satisfy examiners as to their efficiency. The first orthoptic examination was held in London, July 3, 1934, at the

Royal Westminster. The examiners were Messrs. Mayou and Gimblett; Misses Pearson and Maddox.

Early in 1937, the heads of the Hospital Orthoptic Training Schools arranged a meeting of orthoptists and ophthalmic surgeons to hear a series of papers on orthoptics. This was held in April of that year, with Mr. Keith Lyle presiding, at the Royal Society of Medicine. At that meeting proposals for the "Standard of cures" were drawn up. The meeting was so successful that the British Orthoptic Society was founded and Miss Maddox elected president. This Society now has two branches, one for London and the other for the Midlands.

The first (and unfortunately, to date, the last) volume of the British Orthoptic Journal appeared in 1939, with Miss Sheila Mayou as editor, under the auspices of the British Orthoptic Society.

Turning to the United States, we find that in the early part of this century the name of David Wells stands out preeminently for his contributions to the nonsurgical treatment of strabismus. While his interest was chiefly in the treatment of phorias, his methods were applicable to tropias and the set of stereoscopic cards which bears his name is universally known.

While abnormal retinal correspondence in squint was first observed by Johannes Müller in 1826, and continued to be studied by von Graefe, Hering, Helmholtz, Bielschowsky, and many others, mostly Germans, it is only quite recently that it has become a practical problem in the treatment of strabismus. The major amblyoscope has played a very large part in bringing this concept from the research laboratories to the orthoptic clinics, because the instrument constituted the first practical method both for making the diagnosis and for carrying out the treatment, in children. Here we have the essential difference in modern orthoptics, and we should all be deeply grateful to Moncreiff for one of the first discussions of abnormal retinal correspondence in English, in 1929.

Probably the first clinic in this country devoted solely to orthoptics was organized by Dr. L. H. Hardy and Miss Stark at the Fifth Avenue Hospital in New York, in 1932. That this clinic is no longer in existence is one of the major set-backs to the progress of orthoptics. Guibor's clinic at Northwestern University was founded in that same year. In 1933 Bressler started a clinic at the Illinois Eye and Ear Infirmary at the instigation of Allen, while at the New York Eye and Ear Infirmary, Berens was organizing the Department of Ocular Motor Anomalies. There are now hospital clinics devoted to orthoptics in Philadelphia, Cleveland, Detroit, Milwaukee, and Baltimore.

In 1938 the American Orthoptic Council was organized, with three members for each of the three national ophthalmologic societies and three associate members who are orthoptic technicians. In this latter respect it differs from the British Board. The first examination for technicians was held at the New York Eye and Ear Infirmary in the spring of 1939. Today there are 43 certified technicians. The American Association of Orthoptic Technicians came into being just a year ago in Cleveland.

It has not been within the scope of this paper to describe the price paid for the tremendous progress that has been made in the nonsurgical treatment of strabismus in the last 10 years in this country. This brief enumeration of the momentous steps that have been taken must serve as a tribute to the few tireless workers, both doctors and technicians, who have made them possible.

Since this paper was written the Ameri-

can Orthoptic Council has been increased by three members from the American College of Surgeons and a fourth associate member who is the president of the Association of Orthoptic Technicians.

*30 West Fifty-Ninth Street.*

## Discussion

Clara Burri, Ph.D. (Chicago): I am honored by the invitation to discuss Dr. Wheeler's excellent paper.

The speaker has indeed given us a precise and well-organizd story of the development of orthoptics, a story which seems to have its origin much farther back than most of us might have believed. It seems to me that some of the points particularly well brought out are those which emphasize the fact that the fundamental concepts for present-day orthoptics had already been recognized by many ophthalmologists during the course of the seventeenth and eighteenth centuries.

The reason that these early principles did not gain general practical application, and result in establishing exercises as a therapeutic method in the correction of squint, has been because these early specialists did not have the necessary refinement in their instruments with which to detect and measure abnormal retinal correspondence. As the speaker has well brought out, that was probably one of the major factors why the educational treatment of squint failed again and again.

However, there may be still other factors which contributed to this lack of interest in the educative treatment. A careful analysis of the historical background points to some of these factors, and, although Dr. Wheeler's paper failed to bring these out directly, they nevertheless may be recognized.

To me, this history of orthoptics revealed several important fundamental postulates which I would like to stress because these hypotheses still seem to be the most important factors in determining a specific working program, and undoubtedly will influence the future success of orthoptics.

In analyzing the various points of view on the cause of squint held by such brilliant minds as Buffon, Laval, von Graefe Donders, Hansen, Grut, Priestley Smith, and others, it becomes apparent that there are two fundamental and opposing theories. On the one side, we have those who adhered to one or another kind of theory that made defects in the extraocular muscles the causative factor for squints; whereas, on the other side are those who believed that squint was a disorder of the control between convergence and accommodation or a defect in the fusion ability. The one group built their methods of treatment wholly on a defective-muscle theory, which is the motor aspect of binocular vision, while the other stressed innervation, or the neural and sensory aspect.

According to this motor theory of binocular vision, any motor anomalies are due to either overacting or underacting muscles. According to the theory which emphasizes the neuro-sensory side of the process of simultaneous binocular vision, muscle anomalies are the result of deficiencies in the conditioning of the visio-motor apparatus. The development of visual acuity, accommodation, fixation, convergence, and fusion can accordingly, be explained in terms of conditioning of reflexes, and in cases in which these functions fail to develop, various visio-motor anomalies, such as amblyopia, phorias, or squint, may occur. Hence, orthoptics becomes essentially a reëducating or reconditioning process.

It is easy to see how such fundamen-

tally opposite approaches may result in widely different methods of treatment and of results. On the one hand we have muscle function while on the other we establish sensory and neural integration. That the two approaches require different methods of procedures and different fundamental assumptions can easily be seen. In the first place we would merely train overacting or underacting muscles, while in the second we teach or reëducate a complex mental function. A misunderstanding about these fundamental differences in approach was probably another reason why orthoptics failed to gain and hold its place as a clinical procedure in the correction of squint and other muscle anomalies.

Since the author did not lay much stress on the development of orthoptics instruments, I should like to add that like the methods of training so also can we trace back the fundamental principles of our instruments to the workers of the twentieth century. It is surprising that none of the good instruments, such as the synoptophore, came out until 1914. It was with the refinement of instruments that orthoptics came into its own. Until today they are undoubtedly the most valuable aids in orthoptics, although there are many other aids on the market now, some of which are helpful either for diagnostic purposes and training in general or for more or less specific application. A few of the instruments which might be mentioned in this connection are the various squint correctors, the rotoscope, the stereoscope, the metronoscope, and the ophthalmograph.

*25 East Washington Street.*

# VISUAL PROGNOSIS FOR THE AGING LENS

ROBERT VON DER HEYDT
*Chicago*

Observations with the slitlamp, covering a period of over 20 years, have led me to entertain certain views on the prognosis of the various types of opacities seen in the lenses of persons beyond middle life. From these appearances a stationary or healed process may be diagnosed, and slow progress or threat of a stormy progression prognosticated.

## NUCLEAR SCLEROSIS

Sclerosis of the nucleus and the older cortical layers is a normal process continuous throughout life. This may consist of a very gradual reduction in the biologic water content of the lens protein. By virtue of this change the nuclear zone gradually becomes more condensed and the lense flatter. This condensation of the nucleus gives it a higher refractive index, and thus optically the simultaneously occurring flattening of the lens is neutralized. The refraction of the eye is kept in a state of balance in this manner throughout life.

When the process of sclerosis of the lens has attained a certain stage, it is popularly called presbyopia. In certain persons this physiologic hardening, if excessive, may reduce the transparency of the lens and the visual acuity. The increased nuclear density is sharply delimited. In very extreme cases there may be a lens within a lens, or one with two foci. The total lens will present a very different focus through its periphery than through the middle. The difference between the refractive indices of nucleus and cortex may be as great as that between lens and aqueous. The demarcation of the two zones is extremely abrupt when viewed with the slitlamp.

Nuclear sclerosis is the change that brings on myopia in an emmetropic person and enables him again to see near objects without glasses (second sight). *It is not an intumescence.* Patients with this condition should be refracted at more frequent intervals. Nuclear sclerosis is a process of conservation, unless it becomes excessive, and thus somewhat reduces the visual acuity by impairing the transparency of the lens. This loss in visual acuity scarcely ever exceeds 20/40. In uncomplicated nuclear sclerosis, the cortex of the lens is free of changes visible by the slitlamp—although there is a mild sclerosis in relation to that of the nucleus. *Moderate nuclear and relative cortical sclerosis is the normal senility of the lens.* It is in a measure an insurance against cortical changes.

## CORTICAL CHANGES

Cortical cataract is present when there are supranuclear cortical changes in the form of radial and concentric clefts or fissures. When the condition is in the incipient stage, the fissures are filled with a clear fluid. These changes are evidences of friability. Biologically, cortical cataract may be the result of a modification in the normal water-binding capacity of the cortex. Lenses may incline to radial or to concentric fissure formation, or, if the process is a stormy one, a combination of the two types may be present. The incipience of this process presents a characteristic picture under the slitlamp, as is adequately shown in the atlases of Vogt and others. Radial fissures are usually an involvement of the radial lamellae of Rabl, a predisposition to radial spoke formation on anatomic structure lines. Radial water slits in their incipience present *a black area* in the narrow focused beam

of the slitlamp. This occurs because the water is optically empty or void. While these areas predict a threatening opacification, the process may remain stationary for many years. I once found an incipient spoke of this nature recorded in a case history I had taken six years before. There had been no progression during this period, even when it had seemed imminent. If gray spokes are observable with the slitlamp, and there is no evidence of threatened progression (fresh, black fissure formation), one may presume that the development of this cataract is at a standstill or *healed.* (The water within the slits has disappeared and their walls have become opaque or gray.)

Lenses of this type may also show a disposition to fissure formation in a concentric (lamellar) pattern. These, when healed, present the well-known dark plaques observable in the lens when viewed with the ophthalmoscope. They are fissures in a concentric direction, but not separations along definite anatomic lines. The lamellae are too numerous and the fibers too intermingled to allow of this development along a smooth concentric plane. This type of separation in its incipience (invisible with the ophthalmoscope) shows a most characteristic slitlamp picture. There are so many thin fiber lamellae crossing the large concentric fissure that their edges form a plaque with a flat, wavy design. This outlines the area of incipient concentric separation. The wavy lines lie parallel to each other because of the rows of fiber layers each belonging to a single lamella. They bridge the separation at right angles to the direction of the fibers. This I believe to be the explanation of the wavy, combedlike appearance, which, to slitlamp observers, has seemed inconsistent with or inexplicable on the basis of anatomic lines or of direction of fibers. It is of utmost clinical importance that the slitlamp has given insight into this most interesting phase of threatening progression in the development of cortical cataract.

It is not fully understood why lenses show this tendency to fissure formation in the cortex. There have been varied attempts at explanation, such as excessive contraction of the nucleus, retardation in the development of new lens cortex, and traction of the zonule fibers.

The nucleus, because of its weight, and especially because of a softer cortex, may gravitate slightly within the capsular bag. In view of this and of the fact that relaxation of the zonule fibers in efforts at accommodation still continues at this period of life, it is believable that this constant—may we say bouncing?—trauma of the weight of the nucleus on the lower cortex may initiate the changes. This process, in a way, would explain why the incipient lesions of this type are almost always first seen below and on the nasal side. A similar greater gravitation of the nucleus within the lens bag is common in morgagnian cataract.

### Toxic cataract (posterior cataracta complicata)

A common type of lens involvement is known as toxic cataract or cataracta complicata. Ophthalmologists are familiar with it because of its frequent occurrence in conjunction with retinal detachment, high myopia, choroiditis, and other degenerative conditions of the eye. It is surprising to note how commonly it is found in senile eyes that fail to show other pathologic processes. In these one may suspect a low-grade choroiditis or some other vague toxic etiology. Owing to its central (polar) position, a very slight involvement of the lens constitutes a serious threat to the vision. This incipience is a frequent slitlamp finding. There is a green and red iridescence, pos-

sibly due to a thin flake formation, or to a slight separation of the lens from the capsule. Extension is subcapsular toward the equator, and it may progress through the lens substance. The slitlamp picture at this stage is also most characteristic: a porous, asbestoslike change. Here and there one may see flat vacuoles. When the cataract is quite advanced posteriorly, similar characteristic late changes may be seen subcapsularly at the anterior pole of the lens. The rest of the lens is quite transparent. Nuclear sclerosis may often be well advanced, and thereby the intense illumination of the slitlamp becomes diffused, so that the posterior subcapsular change is obscured. *A well-focused narrow beam* carries less light into the lens and will allow of a better visibility of the posterior subcapsular changes. A strong plus lens in the ophthalmoscope will disclose the posterior axial lens clouding if this is sufficiently advanced.

There is no doubt in my mind that this form of cataract is due to an absorption of matter toxic to the lens. The anterior capsule of the lens at the pole, at this time of life, is about five times as thick as is the posterior capsule, and, in addition, it is covered by a protective layer of epithelial cells of equal thickness. The greater permeability of the capsule at the posterior pole, therefore, predisposes that area of the lens to these toxic changes.

A similar posterior subcapsular cataract is described as senile hereditary saucer-shaped posterior cataract (hintere Schalen-katarakt). Because of its flatness, Vogt differentiates it from toxic cataracta complicata. I see no anatomic reason for classifying it as a purely senile type of cataract. Meesmann, in speaking of it and of cataracta complicata, stated that the clinical slitlamp pictures show similarity. In his recent monograph "Hypocalcaemia und Linse" wherein he discusses posterior saucer-shaped cataract, the type which Vogt classifies as senile, Meesmann declares that in view of its pattern and type an exogenous origin cannot, just off hand, be denied. It shows no progression forward into the lens cortex; therefore, may it not be accepted as a toxic cataract occurring in a person whose lens cortex is more sclerosed, and therefore less permeable to the forward spreading of toxic changes? The general sclerosis would account for the sharper flat anatomic delimitation. Lenses presenting these posterior flat subcapsular involvements are practically always of the sclerosed type. Many have reddish nuclei. If these cataracts are well advanced, a stormy, cortical change may superimpose itself. Many neglected old cataracts present this picture.

The characteristic slitlamp evidences of the incipience of this probably toxic cataract give ample warning. No harm is done in looking at these cataracts with suspicion. A therapeutic elimination of the constitutional toxic factor that may be the cause of these cataracts, if found, may inhibit their progression.

This common axial type of cataract is most damaging to visual acuity and may progress rapidly, thus calling for an early operative interference. The lenses in these cases when inspected after their extraction look surprisingly transparent.

While all of these clinical pictures are familiar to many slitlamp observers, the author offers this presentation as a modest effort at an interpretation of their prognostic importance.

*25 East Washington Street.*

# THE STERILIZATION OF SHARP INSTRUMENTS BY CHEMICAL SOLUTIONS*

## Further studies

M. Hayward Post, M.D., and William Moor, B.A.
*Saint Louis*

In a recent paper[1] one of us discussed the sterilization of sharp instruments by chemical solutions. A solution was recommended that had been developed by the author, and tested under various conditions. Much of the laboratory work reported therein was carried out by Mr. William Moor, of the Department of Ophthalmology, Washington University School of Medicine, in the laboratories of Dr. Louis A. Julianelle. The formula for the solution recommended at that time was as follows:

| | |
|---|---|
| Cresol U.S.P. | 2.0 c.c. |
| Formaldehyde U.S.P. | 2.0 c.c. |
| Thymol crystals U.S.P. | 2.0 gm. |
| Ethyl alcohol 95 percent | 94.0 c.c. |

That solution was shown to be highly bactericidal and, in many respects, ideal for the purpose for which it was designed.

Attention, however, was called to the fact that knife handles made of brass and plated with various alloys showed corrosion when partially immersed in that fluid, after periods of about 14 days. In this respect the aforementioned preparation was found to be inferior to those originally developed by Drs. A. E. Ewing and M. H. Post, and designated by them as solutions No. 1 and No. 2.[2]

In the belief that the corrosion noted was due to the action of the formaldehyde present, the elimination of this constituent was thought to be desirable, provided that its removal did not reduce the potency of the solution. It appeared, furthermore, that liquor cresolis compound, owing to its high oil content, would be more desirable as a preservative than cresol U.S.P. The formula for this compound is as follows:

| | |
|---|---|
| Cresol U.S.P. | 500.0 c.c. |
| Linseed oil | 350.0 c.c. |
| Potassium hydroxide | 14.52 gm. |
| Sodium hydroxide | 37.05 gm. |
| Aquae dest. qs. | 1,000.0 c.c. |

It was thought that an ideal solution would result, could both the formaldehyde and the cresol be replaced by liquor cresolis compound. Since the amount of cresol, the active germicide, in liquor cresolis compound constitutes only 50 percent of the latter, it was evident that, in order to maintain an equal efficiency, the percentage of liquor cresolis compound substituted for the 2 percent of cresol should be raised to 4 percent. A like consideration was also apparent in the substitution for the formaldehyde constituent. Liquor cresolis compound to the amount of 8 percent was, therefore, introduced into the new formula. So great a concentration of this substance gave rise to a rather unpleasant odor, not entirely disguised by the thymol still retained. On this account, oil of lavender was added, an ingredient which, though contributing nothing to the bactericidal properties of the preparation, does further increase the oil content to some extent. The formula as now recommended is, therefore, as follows:

| | |
|---|---|
| Liquor cresolis compound | 8.0 c.c. |
| Oil of lavender | 2.0 c.c. |
| Thymol crystals | 2.0 gm. |
| Ethyl alcohol 95 percent | 88.0 c.c. |

* From the Oscar Johnson Institute, Department of Ophthalmology, Washington University. An abstract of this paper was read before the American Ophthalmological Society, at Hot Springs, Virginia, May 28, 1941.

EXHIBIT 1

CULTURE: MIXED STAPHYLOCOCCUS AUREUS, PNEUMOCOCCUS, STREPTOCOCCUS HEMOLYTICUS

| Carrier | Sterilizing Solution | Immersion Time in Sterlizing Solution* | | | | | | | | Control | Incubation Period |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15 | 30 | 45 | 60 | 90 | 120 | 180 | 240 | | |
| Sterile gauze squares | No. 3 | | − | | − | | | − | | + | 24 hrs. |
| | | | − | | − | | | − | | + | 48 hrs. |
| | | | − | | − | | | − | | + | 7 days |
| | No. 4 | + | + | − | − | − | − | − | − | + | 24 hrs. |
| | | + | + | − | − | − | − | − | − | + | 7 days |
| Scissors | No. 3 | | − | | − | | | − | | + | 24 hrs. |
| | | | − | | − | | | − | | + | 48 hrs. |
| | | | + | | − | | | − | | + | 7 days |
| | No. 4 | − | + | − | − | − | − | − | − | + | 24 hrs. |
| | | + | + | + | − | − | − | − | − | + | 7 days |
| Sterile string | No. 3 | | | | | | | | | | |
| | No. 4 | + | + | + | − | | − | − | − | + | 24 hrs. |
| | | + | + | + | + | | − | − | − | + | 7 days |

* Time recorded in seconds.

Experiments have shown this solution to be as germicidal as that previously suggested and apparently even more active on the spores of the hay bacillus. On the other hand, from the standpoint of preservation of the instruments, all requisites seem to be ideally fulfilled.

In order to test the bactericidal potency of this preparation, which may be designated for convenience as solution No. 4, a number of experiments were carried out, as shown in the various exhibits herewith presented. Along with them are also shown, for purposes of comparison, wherever possible, certain data previously presented concerning the potency of the former solution, described therein as solution No. 3. The experiments now reported were carried out in a manner similar to those recorded in the previous

EXHIBIT 2

CULTURE: MIXED STAPHYLOCOCCUS AUREUS, PNEUMOCOCCUS, STREPTOCOCCUS HEMOLYTICUS

| Carrier | Sterilizing Solution | Immersion Time in Sterlizing Solution* | | | | | | | | Control | Incubation Period |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15 | 30 | 45 | 60 | 90 | 120 | 180 | 240 | | |
| Sterile gause squares | No. 4+1% rabbit serum | + | + | − | − | − | − | − | − | + | 24 hrs. |
| | | + | + | + | − | − | − | − | − | + | 7 days |
| Scissors | No. 3+1% rabbit serum | | + | | ± | | | − | | + | 24 hrs. |
| | | | + | | ± | | | − | | + | 48 hrs. |
| | | | + | | ± | | | − | | + | 7 days |
| | No. 4+1% rabbit serum | + | + | + | − | − | − | − | − | + | 24 hrs. |
| | | + | + | + | − | − | − | − | − | + | 7 days |
| Sterile string | No. 4+1% rabbit serum | + | + | + | + | − | − | − | − | + | 24 hrs. |
| | | + | + | + | + | + | − | − | − | + | 7 days |

* Time recorded in seconds.

## EXHIBIT 3

CULTURE: MIXED STAPHYLOCOCCUS AUREUS, PNEUMOCOCCUS, STREPTOCOCCUS HEMOLYTICUS+5% WHOLE BLOOD

| Carrier | Sterilizing Solution | Immersion Time in Sterilizing Solution* | | | | | | | | Control | Incubation Period |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15 | 30 | 45 | 60 | 90 | 120 | 180 | 240 | | |
| Sterile gauze squares | No. 3 | | | | | | | | | | |
| | No. 4 | + | + | + | − | − | − | − | − | + | 24 hrs. |
| | | + | + | + | + | − | − | − | − | + | 7 days |
| Scissors | No. 3 | | + | | ± | | | − | | + | 24 hrs. |
| | | | + | | ± | | | − | | + | 48 hrs. |
| | | | + | | + | | | − | | + | 7 days |
| | No. 4 | + | + | + | − | − | − | − | − | + | 24 hrs. |
| | | + | + | + | + | − | − | − | − | + | 7 days |
| Sterile string | No. 3 | | | | | | | | | | |
| | No. 4 | + | + | + | + | − | − | − | − | + | 24 hrs. |
| | | + | + | + | + | + | − | − | − | + | 7 days |

* Time recorded in seconds.

paper. It should be noted that, like those, the condition of the present observations grossly exaggerate any likely to be encountered in the course of the usual surgical practice.

In the first exhibit, the carrier, scissors, gauze, or string was first immersed for 15 to 30 seconds in a pooled suspension of Staphylococcus aureus, Pneumococcus, and Streptococcus hemolyticus, mixed in equal parts. When scissors were used the blades were opened and the whole instrument violently agitated during the immersion. The carrier was then drained for five seconds, following which it was immersed in a like quantity of the sterilizing solution for the time indicated in the protocol, the scissors being opened and turned over once at the expiration of one-half the indicated time. After five-seconds' drainage, the scissors were placed in a flask of sterile broth and shaken violently for 15 seconds, with the blades again opened. The gauze

## EXHIBIT 4

CULTURE: FOUR-DAY HAY BACILLUS

| Carrier | Sterilizing Solution | Immersion Time in Sterilizing Solution* | | | | | | | | | | | | | | | | | | | Control | Incubation Period |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 10 | 20 | 30 | 40 | 50 | 60 | 75 | 90 | 105 | 120 | 135 | 150 | 165 | 180 | 195 | 210 | 225 | 240 | 360 | 600 | |
| Sterile gauze squares | No. 3 | | | | | | | | | | + | | | | | | | | − | | | + 24 hrs. |
| | | | | | | | | | | | + | | | | | | | | − | | | + 48 hrs. |
| | | | | | | | | | | | + | | | | | | | | − | | | + 5 days |
| | No. 4 | + | + | + | + | + | + | − | − | − | − | − | − | − | − | − | − | − | − | | | + 24 hrs. |
| | | + | + | + | + | + | + | + | + | + | − | − | − | − | − | − | − | − | − | | | + 7 days |
| Sterile silk thread and paraffin | No. 3 | | | | | | | | | | + | | | | | | | | + | − | − | + 24 hrs. |
| | | | | | | | | | | | + | | | | | | | | + | − | − | + 48 hrs. |
| | | | | | | | | | | | + | | | | | | | | + | − | − | + 5 days |

CULTURE: FIVE-DAY HAY BACILLUS

| Carrier | Sterilizing Solution | 10 | 20 | 30 | 40 | 50 | 60 | 75 | 90 | 105 | 120 | 135 | 150 | 165 | 180 | 195 | 210 | 225 | 240 | 360 | 600 | Control | Incubation Period |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sterile string | No. 4 | + | + | + | + | + | + | + | + | − | − | − | − | − | − | − | − | − | − | | | + | 24 hrs. |
| | | + | + | + | + | + | + | + | + | + | + | + | − | − | − | − | − | − | − | | | + | 7 days |

* Time recorded in seconds.

squares and string, on the other hand, were immersed without drainage in the tubes of broth, in order to dilute the sterilizing solution adhering to them as quickly as possible. Considerable turbidity resulted in the tubes so treated, necessitating the streaking of blood agar plates by broth from every tube at the indicated periods and the making of stained smears at the same time.

is, using uncontaminated solution and either sterile or mechanically clean carriers—solution No. 3 seemed to be slightly more rapid in its action than No. 4. Unfortunately, no comparison of the action of the two solutions on string are available. This agent proved the most difficult to sterilize, probably due to its tendency to soak up the culture material. In all instances sterilization was complete

EXHIBIT 5

CULTURE: FOUR-DAY HAY BACILLUS

| Carrier | Sterilizing Solution | Immersion Time in Sterilizing Solution* | | | | | | | | | | | | | | | | | Control | Incubation Period |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 20 | 30 | 40 | 50 | 60 | 75 | 90 | 105 | 120 | 135 | 150 | 165 | 180 | 195 | 210 | 225 | 240 | 255 | |
| Sterile gauze squares | No. 4+ 1% rabbit serum | + + | + + | + + | + + | + + | + + | − + | − + | − + | − + | − − | − − | − − | − − | − − | − − | − − | | + + | 24 hrs. 7 days |

CULTURE: FIVE-DAY HAY BACILLUS

| Carrier | Sterilizing Solution | Immersion Time in Sterilizing Solution* | | | | | | | | | | | | | | | | | Control | Incubation Period |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 20 | 30 | 40 | 50 | 60 | 75 | 90 | 105 | 120 | 135 | 150 | 165 | 180 | 195 | 210 | 225 | 240 | 255 | |
| Sterile string | No. 4+ 1% rabbit serum | + + | + + | + + | + + | + + | + + | + + | + + | + + | − + | − + | − − | − + | − − | − − | − − | − − | | + + | 24 hrs. 7 days |

EXHIBIT 6

CULTURE: FOUR-DAY HAY BACILLUS+5% WHOLE BLOOD

| Carrier | Sterilizing Solution | Immersion Time in Sterilizing Solution* | | | | | | | | | | | | | | | | | Control | Incubation Period |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 20 | 30 | 40 | 50 | 60 | 75 | 90 | 105 | 120 | 135 | 150 | 165 | 180 | 195 | 210 | 225 | 240 | 255 | |
| Sterile gauze squares | No. 4 | + + | + + | + + | + + | + + | + + | + + | + + | − + | − + | − + | − + | − + | − + | − + | − − | − − | | + + | 24 hrs. 7 days |

CULTURE: FIVE-DAY HAY BACILLUS+5% WHOLE BLOOD

| Carrier | Sterilizing Solution | Immersion Time in Sterilizing Solution* | | | | | | | | | | | | | | | | | Control | Incubation Period |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 20 | 30 | 40 | 50 | 60 | 75 | 90 | 105 | 120 | 135 | 150 | 165 | 180 | 195 | 210 | 225 | 240 | 255 | |
| Sterile string | No. 4 | + + | + + | + + | + + | + + | + + | + + | + + | + + | + + | + + | + + | − + | − + | − + | − + | − + | − − | + + | 24 hrs. 7 days |

* Time recorded in seconds.

All inoculated tubes were incubated for seven days, during which period they were observed for growth at 24 hours, and again at the end of seven days. As controls, other flasks of broth were inoculated with 0.2 c.c. of the mixed culture and 30 seconds later the carrier, previously immersed in the sterilizing solution and drained or not, depending upon its nature, was placed in these tubes to determine whether a sufficient amount of the germicide was thus transferred to prevent growth of the culture in them.

Under the conditions of the experiments tabulated in the first exhibit—that in two minutes' time. All controls were positive.

The second exhibit shows the effect upon the time necessary to complete sterilization of similar carriers by the same solutions as those used in the previous experiments when 1 percent of rabbit serum was added to the solution, in order to simulate the condition that might arise should bloody instruments be thrown into the sterilizing solution. In these experiments, some retardation in the action of solution No. 4 could be noticed, and a somewhat greater amount in the case of solution No. 3, as far as could be judged

from the results obtained when using scissors as a carrier. Two minutes, however, was sufficient time for sterilization in all instances. Again, all controls were positive.

The third exhibit records the results when whole blood was added to the mixed culture. Here, once more, definite retardation of the action of both solutions was evident, the amount being approximately equal in the two solutions, to judge from the effect obtained in the case of the only carrier used in both, scissors again in this instance. Complete sterilization resulted once more in two minutes in all experiments. Here, likewise, the controls were all positive.

Exhibits 4, 5, and 6 were carried out in a manner similar to those just reported, except that four- and five-day growths of hay bacillus, in which numerous spores could be demonstrated, were substituted for the mixed bacterial cultures. The action of solution No. 3 was tested on this type of culture only with uncontaminated solutions and cultures, using gauze squares and silk threads as the carrying agents. These results are shown in exhibit 4. Comparison with the action of the No. 4 solution could only be made when gauze squares were used as carriers, since no other agent was used in both solutions. In this instance, a considerable difference in the time necessary for complete sterilization was noticed; that required by No. 4 was definitely less than that necessitated for No. 3. No. 4 took less than two minutes, while for No. 3 somewhat more than two, but less than three, minutes was necessary. More exact data are unavailable, as the intervening periods were not checked when testing solution No. 3.

Exhibit 5 shows the results obtained with solutions contaminated by 1 percent of rabbit serum. Solution No. 3 was not tested in this manner, so no figures are available for comparison. In these experiments, the sterilizing time was increased to an extent such that more than three minutes was required to sterilize string, always the most resistant carrier.

In exhibit 6, in which the culture contained 5 percent of whole blood, solution No. 4 required four minutes for complete sterilization. Solution No. 3 was not tested. In all experiments shown in exhibits 4, 5, and 6, the controls were positive.

Turning now to a consideration of the effect of solution No. 4 upon the various surgical instruments, rubber gloves, and skin, it has been found, as previously stated, markedly superior to that designated as No. 3. In fact, no deleterious effect whatsoever has been observed upon any instrument thus far exposed to its action. Three knives, one with an ivory handle, another with an aluminum handle, and a third with a plated brass handle of the same type as those corroded by solution No. 3 following two weeks' exposure, have been kept together in the same test tube in the solution, unchanged and without addition, since November 14, 1940, a period of six months. No deterioration nor change of any sort has taken place in these instruments. Both black and white rubber dropper bulbs have withstood its action for somewhat over 30 days without loss of elasticity, fading, swelling, or other detectable change.

This solution has now been in use in the operating rooms in Barnes Hospital, in the Eye Service of the Washington University School of Medicine, for the past three months, giving entirely satisfactory results. The only untoward reaction was noted by an instrument nurse, who reported slight blistering of the skin of the wrists upon two occasions, once with solution No. 3 and once with No. 4. In both instances she had gotten the sleeve of her gown wet with the solution, after

which she had pulled her rubber gloves on over the wrist bands, wearing them thus for a considerable time, a procedure obviously to be avoided.

As with solution No. 3, a quick plunge into sterile water, followed by careful drying, is desirable, in order to remove all traces of the solution from the instruments before putting them into use. The water used for this purpose should be placed in a container of such a nature as to permit of easy cleansing, as the water rapidly becomes cloudy, a precipitate forming when the solution remaining on the instruments comes into contact with it.

*In conclusion,* it may be said that to judge from the experiments herein reported, and from our clinical experience, we believe that five minutes' exposure to the action of the solution reported as No. 4 in this series is sufficient for complete sterilization, though longer periods obviously increase the factor of safety without injury to the instruments.

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## References

[1] Post, M. H. Trans. Amer. Ophth. Soc., 1940, v. 38, p. 37; Amer. Jour. Ophth., 1941, v. 24, no. 6, p. 624.
[2] ———. Amer. Jour. Ophth., 1928, v. 11, pp. 18-20.

# ANOMALOUS RETINAL CORRESPONDENCE*

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*Milwaukee, Wisconsin*

Anomalous retinal correspondence is accepted as a clinical concept and has been proved to be a common finding in cases of strabismus.

According to Miss Pugh it is present in more than one half of the cases; Travers quotes the percentage as 40, and others report it as 50, 53.1, 71, 61.5, and 27.4. We have found that 57 percent of the patients with strabismus seen at the Milwaukee Children's Hospital Clinic had an anomalous retinal correspondence.

The probable reasons for the discrepancy in the statistics quoted are the variety of methods used in determining anomalous retinal correspondence and the variable findings frequently observed in the patients in whom it is present. However, it can be assumed that at least 50 percent or more, of all strabismic patients have an anomalous retinal correspondence.

Before proceeding further with this discussion it might be wise briefly to review the normal monocular and binocular spatial relationships present in both single binocular vision and in strabismus; also the abnormal spatial relationships in strabismus (slides shown.)

It may be stated that normal retinal correspondence can be defined as a habit mechanism by which the brain fuses the images from separate nerve impulses derived from the stimulation of corresponding or near corresponding points or areas in the two retinas. Dr. Burian believes that this mechanism in a rudimentary form is an innate quality of the visual apparatus and that the refinements of binocular vision, such as fusional movements and stereopsis, appear later.

As soon as a manifest strabismus occurs there is a resulting stimulation of noncorresponding points. Thus a new habit mechanism of the association of noncorresponding points is initiated.

The longer the strabismus is present and the earlier in life it occurs the more definitely fixed this habit becomes. Eventually a point is reached where the new association supersedes the old habit of normal correspondence. When this occurs the condition can be clinically diagnosed as an anomalous correspondence by one or more of the commonly accepted methods.

This habit is more firmly fixed in cases in which the strabismus is present in infancy in comparison with those in which it becomes manifest after the subject is four years of age. Approximately 83 percent of the 100 patients we have examined who had an anomalous retinal correspondence had a strabismus before they were two years of age.

When examining patients for an anomalous retinal correspondence we use the Bielschowsky afterimage test, the diplopia test, and the major amblyoscopes.

In using the diplopia test, red and green glasses and a muscle light are used. A vertical prism is also used if necessary to elicit diplopia. The test is made for both distance and near; and the patient is checked for homonymous or crossed diplopia, special attention being given to the movement of the eyes. The diplopia findings are compared with the cover-test findings, the two examinations being made consecutively.

On the major amblyoscopes, the subjective and objective measurements are taken. The determination of these angles must follow each other very closely as there frequently is a variation from min-

* Read before the American Association of Orthoptic Technicians, at Chicago, in October, 1941.

ute to minute. The angle of anomaly is at times very quickly affected by macular stimulation, at times disappearing completely. The patient's ability to obtain simultaneous macular perception by macular stimulation is also noted and recorded.

The Bielschowsky afterimage test is also used in an attempt to obtain as complete a check as possible on the type of retinal correspondence present in each case. In this test a vertical line of light is placed before one eye for 10 seconds, then a horizontal line of light before the other eye, keeping the nonfixating eye occluded during each test. A black cross will be seen in space, or a white cross if the eyes are closed, provided the patient has a normal retinal correspondence. If an anomalous retinal correspondence is present, the vertical and horizontal lines will be dissociated. This test is made following macular massage on the major amblyoscopes, for the correspondence is often affected by treatment. We have not found the afterimage test very satisfactory with children under six years of age.

At present we are of the opinion that in patients showing an abnormal retinal correspondence in all three of the aforedescribed tests, the habit is more firmly fixed than in those in whom it is present in only one or two of the tests.

Our observations being incomplete at this time we are unable to give specific figures; however, we have noticed that in some cases the findings on the Bielschowsky afterimage test can be converted from evidence of an anomalous retinal correspondence to a normal correspondence following 20 to 30 minutes of macular stimulation. This conversion does not remain constant for an indefinite period. We look upon this type of case as having a more favorable prognosis toward the establishment of normal retinal correspondence than one in which the test shows consistent anomalous findings.

We are also of the opinion that if neither partial nor occasionally momentary simultaneous macular perception has been obtained at any time following several weeks of intensive treatment the prognosis is to be considered unfavorable.

In treating patients with an anomalous retinal correspondence the most satisfactory results are obtained with the use of both constant occlusion and regular periods of orthoptic exercises several times a week. Constant occlusion is an important factor in the treatment of abnormal retinal correspondence in preventing the development or further strengthening of any so-called bad habits, and in the treatment of amblyopia. Exercises are limited to bimacular massage and stimulation on one of the major amblyoscopes.

The diagnosis of anomalous retinal correspondence on one of the major amblyoscopes must of necessity be accurate. Unless the angle of anomaly is definitely established any other orthoptic treatment given will merely fix the anomalous correspondence more firmly.

In cases in which there is a rather high angle of deviation and in which surgery will eventually be indicated we prefer to have the correspondence firmly established as normal prior to surgery. Experience has taught us that the use of occlusion following surgery, when there is a poorly fixed normal correspondence, can seriously affect the surgical result.

The length of time that occlusion and orthoptics are used in an effort to establish normal retinal correspondence depends in part on the amount of improvement noted, the coöperation of the patient, and, in the case of private patients, on the financial status of the individual. In general we feel that four or five months of treatment without any improvement is a fair trial for orthoptics. In cases in which the ophthalmologist and the patient were anxious to continue, orthoptic treat-

ment has been given for as long as nine months to a year, and in a number of cases normal retinal correspondence was eventually established.

In spite of the fact that single binocular vision with stereopsis is achieved in only a relatively small percentage of cases, we feel that the development of normal retinal correspondence before the use of surgery is of definite value. This is true for two reasons:

First, the surgical correction in the cases in which normal retinal correspondence has been developed is definitely more accurate than in those in which the correspondence remains anomalous.

In a series of surgical cases at Milwaukee Children's Hospital we found a correction of 85 percent of the deviation in the patients who had a normal retinal correspondence as compared to 69 percent correction of the deviation in those who had an anomalous correspondence. This difference was undoubtedly due to a fairly large percentage of cases in which there was normal retinal correspondence with partial binocular vision (orthophoria and fusion of Worth 4-dot test for either distance or near) and further to the fact that in a few cases in which there was anomalous correspondence there was also a tendency to a reversion to the former deviation.

Second, patients with a preëxisting amblyopia, corrected by occlusion showed only infrequently a tendency to revert to the former state of amblyopia if partial binocular vision was established, which cannot occur in the absence of normal retinal correspondence.

There are, of course, a large group of cases in which no degree of binocular vision is developed in spite of the presence of an apparently firmly developed normal retinal correspondence. The studies which Dr. Burian has recently made on the difference and occasional antagonism between peripheral and central fusion may throw some light on this problem in the near future.

*Milwaukee Children's Hospital Clinic.*

# NOTES, CASES, INSTRUMENTS

## SCLERAL HOOKS*†

CONRAD BERENS, M.D.
*New York*

In controlling the position of the eye in operations for detachment of the retina, we have encountered the difficulty of having sutures tear out of the episcleral tissue. For this reason small hooks with acute angles have been devised (fig. 1) for exerting traction on the eyeball in operations in which good exposure of the sclera is desired. The pins are sufficiently short and the angle sufficiently great to prevent their deep penetration into the eyeball. The handle is 95 mm. long, the shaft is 28 mm. in length; the hook is 3 mm. long; and the angle formed by the hook with the shaft is 45 degrees.

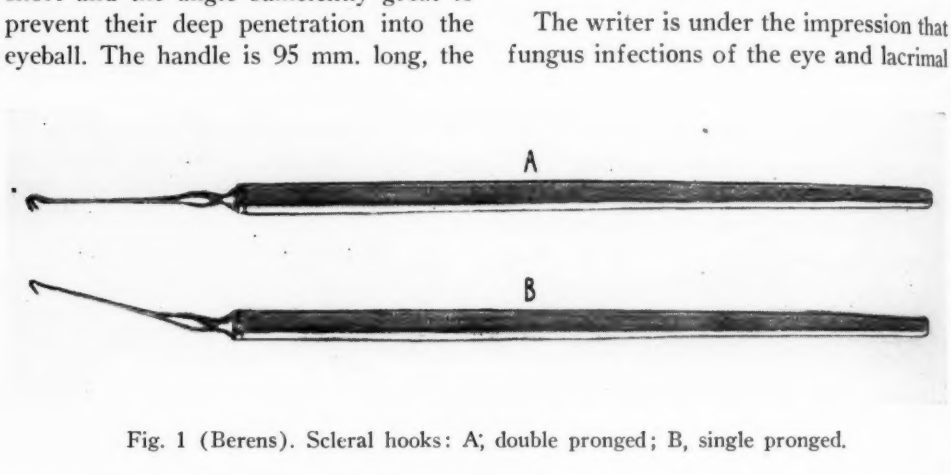


Fig. 1 (Berens). Scleral hooks: A, double pronged; B, single pronged.

Two models are available, one a single hook and the other a double hook, which I prefer for most purposes. The hooks have been found useful in operations on the retina and ocular muscles and in operations on the sclera. In posterior sclerotomy and sclerectomy and in the removal of foreign bodies from the vitreous, as well as in performing cyclodialysis, this type of fixation of the eyeball has proved practical.

*35 East Seventieth Street.*

* Made by V. Mueller and Company, Chicago, Illinois.

† Aided by a grant from the Ophthalmological Foundation, Inc.

## DACRYOCYSTITIS AND BLEPHARITIS DUE TO INFECTION BY ASPERGILLUS NIGER*

### REPORT OF CASES

LLOYD K. ROSENVOLD, M.D.
*Los Angeles, California*

The writer is under the impression that fungus infections of the eye and lacrimal system are quite rare and therefore the following cases are reported.

*Case 1.* A Jewish housewife, 54 years old, came to the Otolaryngological Clinic of the White Memorial Hospital with the complaint of hemorrhages from the nose for several years. Examination revealed much intranasal bloody crusting with a gross appearance of fungus on the surface. Culture proved the fungus to be Aspergillus niger. Sinus roentgenograms demonstrated right-sided ethmoiditis and bilateral maxillary sinusitis. Many dif-

* From the Department of Otolaryngology, College of Medical Evangelists.

ferent treatments for the rhinomycosis were tried, but only partial improvement resulted. It is very likely that the infected sinuses also contained aspergilli, and, in fact, may have been the reservoirs for continuing the infection, but because of the patient's hemorrhagic tendencies, which hematologic studies did not help to explain, surgery of the sinuses was avoided.

After a number of weeks, the patient developed a left-sided dacrocystitis with some secondary conjunctival irritation. Pus could easily be expressed from the sac and the ducts. Culture revealed the pus to contain an Aspergillus fungus. The patient was referred to the ophthalmology clinic, where the lacrimal sac was irrigated. Boric-acid eye washes were used at home. The eye was clinically well in a few days.

*Comment:* It is very likely that the lacrimal sac and conjunctiva were infected by way of the lacrimal-nasal duct. The prompt response to simple local treatment is in sharp contrast to the relatively unsuccessful intranasal treatment. It is very likely, however, that the oral administration of iodides also aided in alleviating the lacrimal infection.

*Case 2.* A middle-aged Caucasian woman complained of a drainage from the right ear with itching and scaling. Examination and culture revealed the infection to be due to a black fungus not unlike Aspergillus niger. Treatment consisted of local cleansing and applications of metacresylacetate (Cresatin), thymol in alcohol, and thymol iodide powder. The ear recovered in about two weeks.

After one week of treatment the patient developed a swollen, red, and somewhat scaling condition on the lids of both eyes, which greatly resembled some form of allergic reaction. A culture was made from the lids and this, too, proved to be a black fungus. Since the author practices otolaryngology, he referred the patient to Dr. Orrie Ghrist of Glendale, California, for care of the eyes. Dr. Ghrist's treatment consisted of local applications of a solution containing 10 gr. of thymol to each ounce of metacresylacetate. The blepharitis disappeared in a few days.

*Comment:* The means of transmission of the fungi from the ear to the eyes was probably by the patient's hands. The favorable results obtained by the use of metacresylacetate and thymol parallels their efficacy as fungicides in otomycosis.

These two cases are reported to call attention to the fact that ophthalmic complications may and do occur in cases of fungus infection of the nose and ears. In neither case was there any evidence of corneal damage from the fungi. The treatment of the ophthalmic fungus infections would seem to be more simple than that of aural and nasal infections.

*128 South Boyle Avenue.*

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## PROTECTION FOR SPECTACLE LENSES DURING OPHTHALMOSCOPY

M. Luther Kauffman, M.D.
*Jenkintown, Pennsylvania*

There are a number of ophthalmologists who, for one reason or another, wear their spectacles while doing ophthalmoscopy. The writer is one of them. Over a period of years it was noted that frequent use of the ophthalmoscope, by which it naturally came in contact with the spectacle lenses, eventually caused numerous fine scratches over the area of contact. This is obviously undesirable. The accompanying illustration (fig. 1) shows how a softer material can be pasted on the ophthalmoscope head, thus preventing the grinding effect of the harder surface.

Various materials have been tested for this purpose. Felt, suede, and velvet were found to be satisfactory at first, but later on fine dust particles collected in the material, and these, in turn, had a tendency to scratch the observer's spectacles. Kid was tried, but was found to be slightly oily and left the observer's spectacles smeared. The best material available, that has thus far been used, has been adhesive plaster; the wet-proof type having a slightly glossier surface, has been found to be the more satisfactory. The technique of application is very simple. The adhesive is cut the proper shape to fit the head of the ophthalmoscope. A hole is punched or burned with a hot round instrument at the proper place. It is then pasted on the ophthalmoscope head, as illustrated.

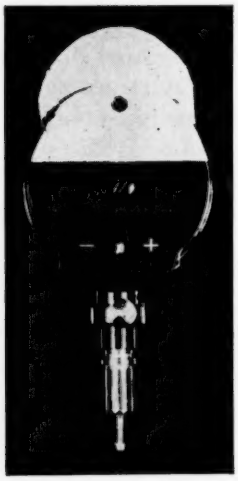

Fig. 1 (Kauffman). Adhesive tape, covering the ophthalmoscope head, to protect the observer's spectacles.

For the May head it is most convenient to apply the material in two pieces, other ophthalmoscope heads can be treated in a similar manner, modifying the details to conform to the peculiarities of the ophthalmoscope. Perhaps in the future the manufacturers will take care of this difficulty for us.

*Medical Arts Building.*

# SOCIETY PROCEEDINGS

EDITED BY DR. RALPH H. MILLER

## MEMPHIS SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

January 13, 1941

DR. CHARLES BLASSINGAME, *presiding*

### MUSCLE TRANSPLANTATION FOR PARALYTIC SQUINT

DR. RALPH O. RYCHENER reported a case of paralytic squint of the left external-rectus muscle treated by transplantation of a portion of the superior and inferior recti muscles. Mr. N. A. P., aged 36 years, had a paralysis of the left external-rectus muscle for eight years. Occasional convergent squinting of this eye had occurred for nine years previously, with some success at control until final paralysis resulted. A tucking operation on the external rectus had been attempted by a general surgeon three years after complete paralysis had developed, but without any apparent result. The left eye was convergent, and there was no temporal rotation in any field beyond the midline. Vision in each eye was normal after a slight correction for compound hyperopic astigmatism.

On September 12, 1940, muscle transplants from the superior and inferior recti were anchored to the stump of the externus, using the Lancaster technique. This muscle was advanced to within 2 mm. of the limbus, while a recession of 5 mm. was performed on the internal rectus. The immediate result was excellent, with development of good motion in all fields.

On December 5, 1940, simultaneous macular perception, fusion, and a moderate degree of stereopsis were present. There was an esophoria of 7 degrees and right hyperphoria of 12 degrees for distance, and exophoria of 6 degrees and right hyperphoria of 14 degrees for near. Four-degree prisms, base down and up, were incorporated in his correction, and worn with perfect comfort. Photographs illustrating the final results were presented.

### TOBACCO AMBLYOPIA

DR. RALPH O. RYCHENER reported three cases of tobacco amblyopia in male adults, all past 50 years of age, all of whom smoked a pipe almost continuously. The usual visual loss accompanied by central scotoma was present in each case, and all responded promptly to withdrawal of tobacco, intensive use of vitamin-B therapy, and mixed treatment internally. All regained normal vision. The interesting factor in these cases was that all were users of the same brand of pipe tobacco.

### HYALINE EXUDATE ON THE POSTERIOR SURFACE OF THE CORNEA FOLLOWING INTERSTITIAL KERATITIS

DR. RICHARD A. MILLER reported the case of R. T., a colored female school teacher, aged 32 years, who was first seen in the Eye Clinic at the Memphis Eye, Ear, Nose, and Throat Hospital on September 30, 1940, complaining of a "skim" over her left eye during the past six months. In 1922, the patient had had a severe infection in both eyes which had caused an almost complete blindness for six months. Shortly after the onset of symptoms she began taking treatment at a clinic in Chicago, Illinois. She was told that her condition was due to hereditary syphilis, and she began taking weekly arm and hip injections. The inflammation in her eyes became progressively bet-

ter, and about seven months after the onset her vision was practically normal. She continued taking the antiluetic treatment through 1923 and 1924, and had no further ocular symptoms. Her present complaint of a "skim" over her eyes and ocular fatigue started about six months ago.

Examination was negative except for the following condition of the left eye: Ophthalmoscopic examination showed a small area of deep corneal infiltration at the lateral border of the pupil. There was a veil of white, transparent material on the posterior surface of the cornea. Slitlamp examination showed numerous deep and superficial sclerosed corneal blood vessels. There was an area of infiltration deep in the cornea, about the size of a pinhead. This area was just lateral to the pupillary border and seemed to extend into Descemet's membrane. On the posterior surface of the endothelium and in the anterior chamber was a transparent, waxy or hyaline exudate somewhat the shape of a spider web. The mass of material was free from the endothelium in some places and touched it in others. The vision was 20/30 and could be improved to 20/20 with glasses. The right eye presented a similar appearance, but much less marked.

### Muscle transplantation for paralysis of the external rectus

Dr. J. Wesley McKinney reported the case of M. J. D., a 10-year-old girl, who stated that her left eye had turned in for the past year following an attack of measles.

She held her head turned to the left. The left eye converged from 4 to 7 degrees but measured 30 prism diopters of esotropia. The rotation of the left eye outward was limited to 5 degrees. The medial rotation was 35 degrees. Comparing this with the rotation of the other eye, which was normal, the external rotation was 45 degrees and the internal rotation 35 degrees. The field of binocular single vision, with the head held straight, came to a point 23 degrees from the midline on the right.

On July 29, 1939, the lateral halves of the superior and inferior rectus muscles were transplanted to the stump of the external rectus. It was thought that no recession of the internus would be necessary because of the low degree of squint. This resulted in external rotation of 13 degrees. The internal rotations were then 28 degrees. The esotropia still measured 30 prism diopters and 5 degrees. The child still turned her head to the left slightly despite the improvement in the external rotation of the left eye. Consequently, on August 6, 1940, a recession of the left internal rectus was performed. The external rotation remains the same, 13 degrees, and the internal rotation is now 14 degrees. The eyes are parallel, and the patient usually holds her head straight, although, if she wants to see a fine object, she will still hold her head a little to the left. There is a residual 12 diopters of esophoria. The binocular field now extends 10 degrees to the left.

### Convergent strabismus with paradoxical diplopia

Dr. J. Wesley McKinney reported the case of J. S. K., a white man aged 33 years. Dr. Lewis had performed a resection-recession operation first on one eye and then on the other for a high degree of convergent squint. The unusual feature of this case was that the diplopia developed after the second operation. The man stated that his eyes had always been crossed and that the eyes had been straight from three to five weeks following the second operation, when they again turned in. It was at this time that the diplopia was first noticed.

When first examined, he had a convergent squint of about 20 degrees. This

was not constant, as the eyes tended to wander. Despite the evident esotropia, the Maddox-rod test showed 14 diopters of exotropia, and there was a corresponding crossed diplopia as mapped out with the red glass on the diplopia field. The cover test, however, revealed 40 prism diopters of esotropia and 12 diopters of right hypertropia. The paradoxical diplopia was made worse by the use of 40 prism diopters, base out. By using 40 diopters, base in, however, the diplopia disturbed him very little.

This man was a painter and decorator, and it was necessary for him to be on ladders and scaffolding for his work. He felt so insecure on account of his diplopia that he had been unable to work. It was thought that, if the retinal images could be separated more widely, suppression could be accomplished more easily, and it would be possible for him to resume his work. It was indicated that this might be the result of the test with the 40-diopters prism, base in and base out.

On May 15, 1940, a recession of the left internus and resection of the left externus was carried out. The eyes have since remained parallel and the diplopia is entirely relieved, although at times he states that if he will look hard for two images, he can find them.

### Amblyopia

Dr. E. C. Ellett reported two cases of recovery from amblyopia in adults, due to forced use of the eyes, and two similar cases in which no improvement resulted.

Mrs. P. S., 28 years of age, presented herself first on May 20, 1901, when she complained of pains in her right eye upon use. The vision in her right eye was 20/60, partly, improved to 20/40. In the left eye her vision was 20/30 plus, unimproved. In 1921, her vision was about the same. Ophthalmoscopic examination was negative. In June, 1927, the vision was R.E. 20/60 with glasses, L.E. 20/25 with glasses. In June, 1934, she developed diffuse central lens opacities in the right eye, the left eye remaining normal. Vision in the right eye continued to fail until, in November, 1935, she could see only moving objects. In the left eye, vision was 20/20 and J1 with glasses. In March, 1939, the vision in the left eye began to fail, and within a week or 10 days vision was reduced to 18/200, improved slightly. She had an absolute scotoma up and out due to macular degeneration. On April 30, 1939, a cataract extraction was performed in the right eye with visual result of 20/25 and J1 with glasses.

Mr. A. K., 30 years of age, was first seen in 1928, when his vision was 20/200 in the right eye, unimproved; and 20/25 in the left eye, improved to 20/20 with a +0.75 D. sphere. His close vision was giving him trouble at this time. He said his right eye had been poor since infancy. He was given a prescription that enabled him to see J1 with the left eye, but only J18 with the right eye. In April, 1931, his vision in the left eye became very bad, but, after having all his teeth extracted, the eye improved and within two weeks the vision was much better. His vision became blurry again in March, 1933, at which time his vision was 20/200 in the right eye, improved slightly, and 20/200 in the left eye, improved to 20/25 mostly, and J2 slowly. Ophthalmoscopic examination showed two round pale lesions at the macula of the left eye. He was given "mixed" treatment and began taking "tuberculin" injections three times weekly. His vision on June 28, 1933, in the right eye was 10/200, improved to 20/200; and in the left eye 10/200, improved to 20/40 and J2. On June 30th, vision in the right eye was improved to 20/40 plus 2. On July 25th, vision was 20/25 in the right eye mostly and J3; 20/50 with glasses in the left eye. On August 29,

1933, vision in the left eye was 1/200 improved to 20/70 partly. On November 13th, vision was 20/20 and 20/25 with glasses. As the vision in the left eye improved the vision in the right eye diminished somewhat. In April, 1940, the vision was 20/40 in the right eye; 20/20 in the left eye with glasses. There was no muscle error, but when the patient used the two eyes together there was asthenopia, which seemed to be due to the difficulty of using the two eyes together.

Mr. C. wore glasses for a right hyperopia, one eye being amblyopic, with vision 20/60 with +7.00 D. cyl. ax. 30°. His good eye was injured by a blow from a baseball and the sight was seriously impaired, but the forced use of the amblyopic eye did not result in improved vision in eight years.

Miss M. had an amblyopic eye with vision 3/200; the other eye was cataractous. The previously good eye was seriously impaired for several years before the cataract was removed, and no improvement in the vision of the amblyopic eye resulted from its forced use for two years.

### Parinaud's conjunctivitis

Dr. Ellett reported that Mrs. M., aged 47 years, had an inflammatory lesion in her right eye of one month's duration. She had arthritis, but all of her physical and laboratory examinations were negative. The trouble with the eye was a conjunctival injection and a granuloma on the conjunctiva below the cornea about the size of a no.-6 shot. This was removed and reported to show leptothrix. She had been treated with the X-ray, potassium iodide, and local anesthetics. There was no return of the granuloma, but two weeks after the onset the conjunctiva appeared more red and swollen all over the eyeball and studded with small white dots, which seemed to be miliary abscesses, and the preauricular and cervical glands were enlarged. Neither the appearance nor the history suggested tularemia (photographs.) She had improved somewhat under the treatment at the time this report was given.

### Two cases of unusual abnormalities of the cilia

Dr. Philip M. Lewis reported the case of a man who had a painful eye for five days and who had been examined by a competent ophthalmologist several days previously. Because of the photophobia, congestion, numerous points of staining on the cornea, and the absence of demonstrable cause, this physician had diagnosed the condition as probably a superficial punctate keratitis. The use of an anesthetic ointment gave only temporary relief.

Examination showed multiple small dots of corneal staining with fluorescein. No foreign bodies were present. Beneath the central portion of the upper eyelid, about 2 mm. above its border, there was a small black dot that proved to be the large end of a stiff cilium projecting just above the surface of the palpebral conjunctiva. Removal with an epilating forceps showed it to be of the usual length and appearance. Complete recovery immediately followed.

Explanation of this abnormality was most difficult. There was no history of a previous chalazion which by rupturing might have left a small opening into which the distal end of a loose cilium might have become inserted.

The second case was that of a man who felt for several days that something was in his eye.

Examination showed a cilium projecting about 4 mm. from the enlarged opening of a meibomian gland at the center of the upper eyelid. The free end of the cilium scraped against the cornea continuously. Removal gave immediate relief.

INCLUSION BLENNORRHEA

DR. PHILIP M. LEWIS reported a case of inclusion-body conjunctivitis. M. W., a white female, was 14 days old when first seen. She had a purulent discharge from the right eye that had begun seven days previously. At first the eye became red, slightly swollen, and had a mucous discharge, but the secretion rapidly became purulent.

When first seen the conjunctiva of the lower lid showed a little thickening but only very slight roughness. Smears made from the purulent secretion were negative for the gonococcus and also for other organisms. Treatment for two days with boric-acid irrigations and the usual local antiseptics brought about no improvement. Epithelial scrapings were therefore taken and were stained and examined by Dr. L. W. Diggs who demonstrated the inclusion bodies in the cytoplasm of numerous epithelial cells.

Treatment was started with sulfanilamide, 0.8 percent, in normal saline solution locally every three hours. Internally 3 grains of sulfanilamide was given as an initial dose and 1 grain every six hours thereafter. There was a definite improvement by the next day, and recovery was complete on the fifth day after the sulfanilamide therapy was started.

J. Wesley McKinney,
*Secretary.*

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## COLLEGE OF PHYSICIANS OF PHILADELPHIA

### SECTION ON OPHTHALMOLOGY

January 16, 1941

DR. FRANCIS HEED ADLER, *chairman*

PRESENTATION OF A CASE OF CHIASMAL LESION

DR. WALTER I. LILLIE presented the case of a white man, aged 24 years, with intermittent symptoms of increased intracranial pressure of two months' duration. He was admitted to Temple University Hospital. One month prior to admission the patient noticed that he had suddenly developed a bitemporal hemianopsia and diplopia. General examination disclosed a bundle-branch block associated with an enlarged heart and a lesion of the mitral valve. The neurologic examination by Dr. Fay revealed minor reflex disturbances, and the evidence pointed to a diffuse basal lesion, either inflammatory or vascular in type, or an aneurysm of the anterior communicating artery. X-ray studies of the skull were negative. The ophthalmologic examination revealed that the vision was reduced to 6/30 in each eye. The upward ocular rotations were unevenly limited, and there was vertical diplopia. The perimetric fields revealed a complete bitemporal hemianopsia with bilateral central scotomata. The fundus examination was negative.

The spinal-fluid pressure was increased to 24 mm. Hg; it dropped rapidly with the loss of 6 c.c. of the fluid. The spinal-fluid Wassermann and colloidal gold tests were normal. Three days after this drainage the vision in the left eye improved to 6/10, and there was a disappearance of the central scotoma in that eye; the field of vision in the right eye remained the same.

Special studies for bruit were negative. In an attempt to establish the differential diagnosis between arachnoiditis and aneurysm, and thus to determine if the problem was surgical, an encephalogram was requested by the members of a neuro-ophthalmo-roentgenologic conference. The studies were negative. An aneurysm of the anterior communicating artery ruptured suddenly, five hours after the encephalogram was made, and the diagnosis was confirmed at autopsy.

This case is presented to show that

aneurysms about the optic chiasm may produce signs and symptoms that may be more suggestive of acute basal arachnoditis than of aneurysm. It demonstrates that all the diagnostic procedures are necessary to determine whether a surgical procedure is advisable. In this case the encephalogram would have ruled out the necessity of surgical interference had the patient lived. Aneurysms of this type are not operable.

### Recent progress in central-field studies

Dr. John N. Evans, by way of introduction, pointed out that even the Hippocratic school had considered the possible participation of blood vessels in the formation of defects of the visual field.

Basic anatomic and physiologic evidence was then presented on which the hypothesis of angioscotometry rests. The morphologic and topographic features of the angioscotoma were discussed, following which a presentation of charts showed the physiologic variations of the defect. Examples of a wide variety of studies of pathologic cases were given, their features and significance explained, and their usefulness in routine clinical work stressed.

The simple and rapid technique was emphasized, contradicting the erroneous impression that the work is complicated and tedious. In closing his presentation, the speaker showed a tabulation of angioscotometry studies by workers in foreign lands and in the United States. Besides more than 30 original contributions in this group, it was seen that angioscotometry is now included in all the standard textbooks on visual fields and occupies increasing space in the current literature.

Warren S. Reese,
*Clerk.*

## NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

January 6, 1941

Dr. Morris Davidson, *presiding*

### Symposium on virus diseases

### Methods of virus culture

Dr. Wolcott B. Dunham discussed this subject during the instructional hour and demonstrated the lesions produced in egg membranes by different viruses.

### General aspects of virus diseases

Dr. Ward J. MacNeal traced the history of the discovery of the filtrable viruses from Iwanowski's finding of the etiologic agent of tobacco mosaic disease in 1892 to d'Herelle's bacteriophage in 1917. He showed the close relationship between the filtrable viruses, which are believed to be living particles, and the lytic enzymes that are produced by living cells. Among the latter, the best known are pepsin and trypsin. Lytic enzymes may be produced by a great variety of living things. Of special interest here is the lysozyme, first observed in 1909, that is present in egg white, and other agents quite similar to it that are present in nasal mucus, tissue extracts, and other secretions. Extracts of leukocytes contain this and also other enzymes that possess different properties.

The extraction of similar lytic enzymes from various bacteria as well as their preparation from filtrable viruses themselves has been recorded in the recent literature. The subject is obviously becoming more and more complex, but a semblance of order is beginning to appear. We may now recognize one distinct group designated as Rickettsia, in which are placed the filtrable agents of typhus fever, Mexican typhus, Rocky Mountain spotted fever, and possibly trench fever. The fil-

trable agents are of fairly large size and are sometimes oblong in shape, so that they possess a distinct resemblance to minute bacteria. The saprophytic filtrable microbes of Barnard also constitute a fairly distinct group; also the group of viruses causing destructive diseases of plants. Among the others the distinctions are by no means so clear. One may, however, recognize the bacteriophage group, the pox group, and also the group of neurotropic viruses.

By means of lantern slides the lesions of some of the tobacco mosaic diseases were demonstrated; also photomicrographs of the virus particles, particularly of vaccinia and of bacteriophage. The beneficial effect of Staphylococcus bacteriophage in the treatment of cavernous-sinus thrombosis was illustrated by chart records of clinical cases.

### Epidemiology of inclusion conjunctivitis

Dr. Phillips Thygeson stated that inclusion conjunctivitis is most common in the newborn infant who acquires the infection during birth from a benign virus cervicitis of the mother, but the disease also occurs in children and adults. The source of infection here is also genito-urinary from cervical and urethral discharge, and transmission to the eye is extremely rare. Swimming pools, prior to chlorination, were a frequent source of infection, due probably to the common habit of urinating in pools. Except for swimming-pool transmission, there is a direct parallelism between the epidemiology of inclusion conjunctivitis and gonorrheal ophthalmia.

Dr. Thygeson showed slides of inclusion bodies obtained from the cervix and from the conjunctiva as well as from the experimental conjunctivitis in the baboon, induced by transfer of cervical scrapings.

### The production of iris vesicles with the virus from a case of herpes zoster

Dr. Arnold J. Gelarie found that patients with rheumatic affections showed subjective and objective improvement when attacked by herpes zoster. At post-mortem examination, a virus agent was isolated from the Gasserian ganglion of a patient who had an attack of herpes zoster in the left obturator region 1½ years prior to death. When this was injected into rabbits it produced encephalitis and vesicles of the iris and ear drums.

In another case there was a herpes zoster ophthalmicus and also herpes of the peroneal nerve. The patient died of metastases from a sarcoma of the left sciatic nerve. A virus agent isolated from the Gasserian ganglion when injected into rabbits also induced vesicles of the iris.

Primary virus disease of the eye does not seem to occur except following inoculation. Usually it is secondary to a virus disease elsewhere in the body. The oculist is sometimes the first to diagnose a generalized virus disease from an eye lesion; for example, in measles and rubella and sometimes in pemphigus vulgaris and leukemia.

### Lymphogranuloma venereum as a cause of chronic conjunctivitis

Dr. William Curth presented a case of chronic unilateral conjunctivitis due to primary infection with the virus of lymphogranuloma venereum that occurred six years previously, following perverted sexual intercourse. At that time the eye showed unilateral conjunctivitis with swelling of the preauricular and submaxillary nodes. This was believed to be an obscure disease of the conjunctiva simulating Parinaud's conjunctivitis. Agglutination tests for B. tularensis and tuberculin tests were negative. When seen six

years later both lids were red and swollen and there was a marked destruction of the inner surface of both lids. The globe was injected and the cornea opaque. At no time was there pain. The Frei test was found to be strongly positive. Biopsy from the lid showed chronic granuloma. Intravenous injections of Frei antigen followed by treatment with sulfanilamide gave a relatively satisfactory result. Since the clinical picture simulates Parinaud's conjunctivitis, the virus of lymphogranuloma venereum has been established to be one of the causative agents of Parinaud's conjunctivitis.

*Discussion following symposium.* Dr. Samuel B. Frank stated that herpes simplex and herpes zoster are two unrelated diseases and can be distinguished by inoculation into rabbit cornea. Herpes zoster cannot be transmitted to the experimental animal. Patients with herpes simplex of the cornea show a definite response to formalized herpes virus. Punctate keratitis might frequently be due to herpes simplex. One patient who had recurrent attacks of punctate keratitis was completely cured following the administration of formalized vaccine.

Dr. Martin Cohen said that some 25 years ago he examined many cases of trachoma at Ellis Island, and only once did he find inclusion bodies. Several years later there was an epidemic of gonorrheal vaginitis and conjunctivitis at Randall's Island Hospital. Vaginal smears showed mixed infections and some inclusion cells. One patient, blind, submitted to conjunctival inoculation from a proved cervical inclusion-body infection and developed an inclusion blennorrhea. The incubation period was seven days. The infection started with a sort of papillary raspberry of the tarsal conjunctiva of the upper lid and then both eyes became involved. There was also a mucopurulent secretion lasting four months, then the conjunctiva became quite normal again. Apparently this was a mixed infection. Inclusion-cell conjunctivitis is an independent conjunctival disease, independent of follicular conjunctivitis, independent of trachoma and of gonorrheal conjunctivitis—once trachoma, always trachoma.

Dr. Morris Jaffe said that he knew of four patients who had cavernous-sinus thrombosis long before the days of chemotherapy and bacteriophage; three of them are dead. Recently another such patient was treated with sulfathiazole to the point where the white count dropped to 3,000, but this was readily overcome by blood transfusions. This patient is alive today.

Dr. Ward J. MacNeal stated that the use of sulfathiazole was very satisfactory but that all such patients should be observed. He told of a case of septicemia in which treatment with this drug was followed by recovery, but the patient became blind. Dr. MacNeal attributed this blindness to some other lesion. Four months later the patient had a convulsion, and an abscess of the frontal lobe was found. It does no harm to keep such a patient under observation and it may prevent serious complications.

Dr. Phillips Thygeson stated that in children and adults inclusion virus is the cause of one type of acute follicular conjunctivitis. Inclusion conjunctivitis in the newborn is a papillary conjunctivitis. The conjunctiva of the newborn does not seem to be able to react by follicular hypertrophy until some months after birth, but if the conjunctivitis persists, follicles may eventually develop.

Dr. Arnold Gelarie stated that the virus is not a disease of man or animal but of the single cell. The host of the virus is a single cell and even if detached from the body can keep the virus alive. As a rule, viruses are harmless, but the environment in which the virus multiplies be-

comes toxic, becomes specific, and, in some cases, the virus adapts itself to a different environment. When chemically combined with some other virus or other protein, it assumes a different action and produces a different disease. Viruses obtained from both herpes-simplex and herpes-zoster cases induce arthritis, and each virus separately induces vesicles in the iris.

Dr. Victor Syracuse said that the newer findings in immunology show that the affected tissues can act as specific antigens and that the antigenic properties of living cells and viruses were not unlike. This is not only a complex problem but opens up a whole new field that is still unexplored.

Sidney A. Fox,
*Secretary.*

# AMERICAN JOURNAL OF OPHTHALMOLOGY

*Published Monthly by the Ophthalmic Publishing Company*



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## PROTECTIVE MEMBRANES OF THE EYE

The ways of nature are more constant and better established than our plans and devices for meeting any particular emergency that we have to face, perhaps for the first time, in ophthalmic surgery. The article (Amer. Jour. Ophth., February, p. 208) by Dr. Curdy illustrates the value of working with the force of gravity instead of against it. The writer remembers distinctly a case in which a small bird-shot was lodged in the upper angle of the anterior chamber. To dislodge this, when the patient was lying flat on his back, might have been quite impossible. But when he was sitting up, with his head steadied from behind, it was easily displaced with a wire loop introduced from below, and promptly fell out of the eye.

When a bit of iron, or steel, is deeply embedded in the vitreous, the tissue in front of it may offer a resistance that cannot be overcome by the attraction of a magnet outside of the eye, or even brought between the lips of the external wound. Attempts to cut through this tissue with knife or scissors failed to reach the foreign body. It should be borne in mind that the pole of the magnet, placed in contact at the crossing of the blades of scissors, will make the blades a part of the magnet. Then every snip with the

scissors cuts toward the foreign body, which is constantly drawn between the blades. With this guidance of the magnetic force, the incision is certain to reach the foreign body. It usually comes away as the scissors are withdrawn. This help of nature has achieved a successful magnet extraction when powerful giant magnets had failed to secure it.

Gravity and magnetic force we somewhat understand. But there are other conditions that are very obscure on which we have to rely somewhat blindly. The transparency of the ocular media is a condition of normal vision. Such transparency depends on the protective influence of the transparent membranes which enclose and protect these media. How they do this, we do not know; but they do it. When we make a puncture in the lens capsule, and the aqueous reaches the lens substance, its transparency is lost. We know that the aqueous and vitreous differ in chemical composition. We can only account for this by some filtering powers in the membranes enclosing them, which have developed along with the aqueous, vitreous, and crystalline lens.

It seems irrational, in a cataract extraction, to remove more substance than is necessary. The opaque portion of the lens that obstructs vision is all that needs to be removed. This, of course, implies the removal of the firm lens nucleus. Solid fragments of nucleus can act like foreign bodies, when they are allowed to come in contact with the iris. But in the writer's experience, no harm has resulted from leaving soft cortex, or the lens capsule, within the eye. If the lens capsule has been torn to shreds, left hanging in the eye, these may become points for lodgment of blood and exudate that may lead to the obstruction of vision, called secondary cataract, making necessary an additional operation. When the lens capsule is clear, and opened by a smooth, clean incision, and the nucleus removed, secondary cataract has been surprisingly rare. Danger of leaving soft cortex in the eye, after the lens nucleus with opacities has been removed, has been greatly overrated. The danger has really been from other unnecessary injuries to the eye in attempting to remove what is better left untouched.

The eye with its clear media and clear membranes is something unique. To apply to it analogies based on the behavior of other tissues in the body is to mislead ourselves. The processes of nature have been perfected through unknown ages, and uncounted generations of evolution. It is safer to trust to them than to follow blind faith in operative skill and the idea that the more tissue we can remove the better.

Edward Jackson.

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## VASOMOTOR CONTROL OF RETINAL ARTERIES

Contractility, a property inherent in many forms of protoplasm, plays a most important part in bodily activities. It contributes in varying degree to the processes of nutrition, secretion, and excretion.

Contractility is especially manifested in muscle, voluntary or involuntary. The action of involuntary muscles is essential for life itself, while that of the voluntary muscles is indispensable in the struggle for existence among most forms of animal life.

Beyond the perpetual working of that great natural pump, the heart, the circulation of the blood depends in great measure upon the controlled activity of those muscular structures to which we apply the term "vasomotor." Although chiefly guided by remote or reflex control, through the vasomotor nerves, it has been argued that in some instances the vasomotor musculature also reacts, more

directly, to chemical or physical stimuli.

As regards the varying blood supply of individual organs, W. R. Hess's monograph on the circulation of the blood assumes a "nutrition reflex" made up of three parts. First comes local vasodilatation arising from chemical stimulation by the products of metabolism. Second, this local dilatation may be associated with reflex vasocontraction in other vascular areas. Finally the total amount of circulating blood is increased by reflex contraction of the spleen and the large venous trunks.

The organs most readily affected by diminution of the blood supply are the heart and brain, and they are therefore particularly sensitive to the "nutrition reflex." Other vascular areas, particularly visceral and muscular, lend themselves to vasocontraction, since in them a brief period of relative anemia is of minor significance.

A special branch of anatomic and physiologic research has been devoted to the nervous mechanism of circulatory reflexes. Various investigators described a "depressor nerve," originating in the arch of the aorta, and sensitive to increase of pressure within that huge artery. More recent studies have pointed to the importance of the nerves of the carotid sinus (the dilated portion of the internal carotid artery, just beyond the point at which it branches from the common carotid) as an important center for circulatory reflexes.

Stimulation of the aortic or sinus nerves brings about a fall in blood pressure by inhibition of the heart's action and by peripheral vasodilatation. Suprarenal secretion is controlled by these vasosensory nerves.

For a long time it was believed that the quantity of blood within the cranium did not change and that the caliber of the vessels in the cranial cavity was invariable, so that the only way in which cerebral circulation could be influenced was by alterations of intravascular pressure. For many years experimental investigation failed to disclose the presence of vasomotor innervation of the vessels of the brain.

Because embryologically the retina is a part of the brain and its circulation a part of the cerebral circulation, conclusions as to the blood supply of the brain have been held applicable to that of the retina. Alike as to brain and retina, it was persistently believed that the arteries were terminal in character, their only intercommunication being by way of capillary anastomoses. More recently the absolute uniformity of this principle has been questioned as regards the brain.

Discovery of the cerebrospinal fluid, varying in amount through secretion or resorption, and passing freely from one cavity to another of the central nervous system, constituted an important modification of the original belief that the volume of blood in the intracranial cavity was invariable.

Some preliminary demonstrations of active change in the caliber of the cerebral arteries were contradicted by other writers, who pointed out that the influence of anastomoses between the intracerebral and extracerebral vessels had been overlooked or underestimated. Forbes and others, by microscopic study through glass windows inserted in the skulls of experimental animals, were able to observe dilatation and contraction of the larger pial vessels, and these changes of caliber were later explained as due to definite vasomotor nerve control. Still further investigation has shown that the vessels of the choroidal plexus behave like those of the pia mater.

Porsaa (Acta Ophthalmologica, 1941, Supplement 18) points out that relatively few systematic investigations have

been undertaken with regard to vasomotor reactions in the retinal arteries. As to the anatomy of the cerebral arteries there are apparently no very radical differences between man and the other mammals. But for experimental purposes some difficulty of comparison is created by the fact that the central artery of the retina in other mammals receives some of its blood supply from the external carotid artery, whereas in man and monkeys the source of supply, at least with few exceptions, is exclusively in the internal carotid.

The walls of the largest retinal arteries in man possess a definite middle tunic composed of three layers of muscle fibers. Kolmer has shown that even arterioles whose diameter is not more than thirty microns contain a distinct layer of muscle cells. Furthermore, according to Schaly, the precapillary arterioles and capillaries themselves have contractile elements in the form of Rouget cells.

Attempts to demonstrate the presence of vasomotor nerve fibers in the retinal vessels have been inconclusive, and the existence of such fibers is denied by most research workers. But it should be remembered that in the cerebral vessels the existence of a vasomotor mechanism was recognized physiologically long before vasomotor nerve fibers were demonstrated anatomically.

Porsaa's monograph devotes a good deal of space to description of research work on cat eyes, under narcosis produced by injection of a barbiturate drug into the gluteal muscles, and using Lambert's modification of Koeppe's method for microscopic examination of the ocular fundus.

It was found that the retinal arteries, like the arterioles of the pia mater, contracted in response to increase of systemic blood pressure. It was found conversely that the retinal arteries dilated under a fall in blood pressure, regardless of the means by which the reduction of pressure was accomplished. There was evidence that the retinal arteries were not under direct influence of the vasosensory nerves, and stimulation of the sympathetic nerves did not apparently cause contraction of the vessels.

Porsaa's investigations further included experiments on six animals as to the effect of inhalation of amyl nitrite upon the caliber of the retinal vessels. With the fall in general blood pressure, the vessels dilated, and the maximal dilatation persisted as long as inhalation of the drug was continued. It was also possible, with appropriate dosage of the drug, to produce marked dilatation of the retinal vessels without appreciable change in general blood pressure.

From these and other facts Porsaa argues that the action of the amyl nitrite is directly upon the vessel wall and does not arise merely from general relaxation in vascular tone. But if an excessive dosage of the nitrite was employed, with rapid fall in blood pressure, either actual contraction of the arteries occurred or the dilatation was very slight. For this reason Porsaa believes that Lambert, who in 1935 (American Journal of Ophthalmology, volume 18, page 1003) reported constriction of the retinal vessels after inhalation of amyl nitrite, must have used excessive doses of the drug.

As to the mutual relation between intraocular pressure and the caliber of the retinal vessels, Porsaa's results indicate that the variations in either condition are entirely independent of those in the other, or at any rate that there is no causal connection between the two.

It is Porsaa's opinion that the retinal arteries possess an individual tonus which is directly regulated by the intravascular pressure, in such a way that any rise of that pressure increases the tone of the arteries and causes them to contract,

whereas a fall in pressure causes relaxation and dilatation. Neither the vasosensory nerves nor the sympathetics play any part in this reaction, nor are several of the phenomena observed explicable on the basis of a chemical stimulus.

The behavior of the retinal vascular system is an example of the automatic adjustment of bodily function to bodily need. For the highly sensitive tissues of the brain and retina, a constant blood supply is too vital to permit these structures to share in the general mechanism of vasodilatation and vasoconstriction which prevails in the body as a whole. These highly specialized areas, therefore, appear to have been provided with their own peculiar type of regulation.

W. H. Crisp.

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## OPHTHALMO-OPTOMETRIC RELATIONSHIPS

Another of the many milestones erected in ophthalmo-optometric relationships was recently left behind. The call to place this one issued from the camp of the chiefs of the Society for the Prevention of Blindness, and its purpose was to hold a powwow between representatives of the Committee on Optics and Visual Physiology and representatives of the American Optometric Association, plus a few invited guests, to discuss the eye welfare of the public. Accordingly there foregathered on the day before the third new moon in the village of New York some 10 or a dozen chiefs from each tribe. A preliminary meeting was held by the Ophthalmologist Tribe at 5:30 to determine whether there was unanimity of opinion among them on the topics that were proposed for discussion; and finding after two hours of discussion that, as usual, there was none, they proceeded *en masse* into the main wigwam of the Society to meet and greet the delegates from the Optometric Tribe. A delightful repast was provided which did not interrupt the preliminary consideration of the subjects to be discussed at the meeting.

Adjourning from the festal board to the council chamber the pipe of peace was lighted and passed from hand to hand until it was glowing nicely. At this point the question of a new optometry bill recently passed by the Senate of the State of New York was introduced for discussion. On its face it appeared to give the optometrists a right to "treat" eye injuries. This was obviously most displeasing to the ophthalmologists. At once an optometrist chief, and in turn all of his fellow-councillors, stated that they had not been informed of the bill before its presentation and did not know who instigated it, and they completely repudiated it. The peace pipe whose glow had appeared momentarily somewhat dim, now began to brighten again and everything looked propitious. But, unfortunately, one Chief of the Optometrists couldn't let well enough alone, but must try repeatedly to point out that the bill didn't really mean what the Ophthalmologists thought it did, thereby almost snatching defeat from the jaws of victory. The pipe was by now burning low, and for a moment it even looked as if it were going out, but on assurance that the Optometrists would join the Ophthalmologists in killing the bill, all again became serene.

The question of a bill for opticians was next on the agenda. It was attacked by the optometrists largely on the ground that the opticians had no set-up for control or training of their group and that they were advantageously controlled, as much as could be, under existing optometric regulations. So their bills for independence were politely, but firmly, opposed by the optometrists and only half-heartedly defended by the ophthalmolo-

gists. This probably because the star organization of the optician group has never been able to ally the ophthalmologists with it, largely on account of the unwillingness of its members to stand squarely on the one most salient feature of their program that should endear them to eye physicians and surgeons; namely, inclusion of no opticians in their membership who perform refractions. When confronted by the fact that certain of their numbers, though not actually refracting, nevertheless owned shops in which eyes were tested for glasses, they stated that if a little time were given they would see to it that this practice was stopped in their membership. Too much time has elapsed, and the condition still exists. They may as well realize before too late, if it isn't already too late, that this dilly-dallying has cost them the degree of professional support which with a little more courage they might have enjoyed.

Then came the question of glaucoma. Two important items were considered: how best to instruct the public, and shall ophthalmologists give medical lectures to optometrists. Here the diversity of opinion was all in the ophthalmologist's ranks, and was great. The optometrists were solidly for receiving this training if this could be done. The rescinding of the American Medical Association bill that very broadly forbids professional relationships between physicians and laymen by the Ophthalmic Section of the American Medical Association in June, 1941, was the special occasion for this discussion. The controversy ranged from the belief in a policy of all-out aid to optometrists to the thought that even refraction was a medical problem and should be in the hands of medically trained persons! Much, much talk ensued, the culmination being the adoption of a motion to recommend maintenance of some such body as that gathered at this meeting to serve as a committee under the auspices of the National Society for the Prevention of Blindness for consideration of such matters as pertain to ophthalmology and optometry and especially to scrutinize and discuss all bills on these subjects before they are presented to legislatures. The proposer of the motion stated that he suggested that the committee be formed by the National Society for the Prevention of Blindness, because the matter might well get further if the committee were thus organized rather than otherwise; that there had been a joint committee of physicians appointed from the various ophthalmic societies about 14 years previously for such a purpose, but that it had not succeeded through the years in so doing; and that, furthermore, there was likelihood that the action of the Ophthalmic Section in rescinding the aforementioned bill would not be ratified by the legislature of the American Medical Association this spring, in which case there would be no fruit from the present discussions if action were dependent on the initiative of organized medicine. Just how the medical half of this committee, who were all members of the American Medical Association could act contrary to the instructions of this body was not made quite clear, but the assembly had already jumped higher hurdles than this during the evening, so this one did not give any pause. Someone suggested that the Public, whose anatomy was to be manipulated, should be represented on this committee; but, there being only 130 million of them, this suggestion was not even brought to a vote. The same speaker thought that there should be at least one optician on the committee, but the opticians having already been put in the dog-tepee, in absentia, by the optometrists, no effort was made to include them either. By this time the peace pipe was burning brightly, and the wigwam was filled with

its soothing smoke. The hour lacked little of midnight, so a vote was taken and it was so ordered, and the meeting was adjourned *sine die*.

Well, what of it? This, at least: We met a group of fine men, everyone concerned primarily with public welfare. The earnest effort of all to accomplish something worthwhile for the general good was most impressive. This spirit of get-together must some way be fostered and not allowed to grow cold and die. To do this, frequent conferences are necessary. How may this be done? Obviously we cannot all pack our grips every week or two and trail two or three thousand miles for a few hours' conference, as many did for this occasion. But there is an answer. The problems that would naturally come before this group are concerned largely with state matters. Therefore, the American Medical Association permitting, let there be formed similar small committees of ophthalmologists and optometrists in each state to meet monthly, and finally present matters that concern the national body at annual or semi-annual conferences of these state committees with the National Committee. This plan would certainly foster better feeling and understanding locally and nationally, and by such action the outcome of this conference will become an important milestone and not just another gravestone.

Lawrence T. Post.

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## BOOK NOTICES

A HANDBOOK OF OCULAR THERAPEUTICS. By Sanford R. Gifford, M.D. Third edition, thoroughly revised. Clothbound, 410 pages, index, 69 illustrations. Philadelphia, Lea and Febiger, 1942. Price $4.00.

The 10 years that have elapsed since the appearance of the first edition of this useful book has seen the development of therapeutic agents that have in part revolutionized ophthalmic practice. The most important and striking of these has been the increased adaptation of the sulfonamides. The value of their employment in gonorrheal ophthalmia, inclusion conjunctivitis, as well as in certain kinds of uveitis, has become established. The description of this group of drugs and the dosage and methods of their use form an important chapter in the revised edition of the author's well-known and popular book.

The value of the work is further enhanced by the inclusion of new and important information on the pharmacology of drugs affecting the intraocular mechanism, on vitamins and accessory food factors, drugs producing local and general vasodilatation, and anesthetics useful in ophthalmology. The older agents that have been tried and found true are rightfully preserved in their proper places. Advances in our knowledge concerning physical and irradiation therapy are discussed and evaluated. The bibliography has been brought up to date. New illustrations have been added and the page content has been increased by 138 pages over the first edition.

In his introduction the author points out the difficulties of the proper evaluation of new therapeutic factors and makes a plea for a thorough trial of agents that fill a gap in the therapeutic equipment of the scientific ophthalmologist, with every possible attention paid to control and the discipline of research. New agents should be greeted with reserve, the older ones of recognized value kept until replaced by better.

The author's mature judgment and practical experience is reflected in every page. If the reader will follow the text he will practice expert and modern ophthalmology. The book is one to have at hand to turn to in moments of doubt,

and a knowledge of its contents will add to one's resourcefulness in the treatment of rare as well as of ordinary ophthalmic conditions. Derrick Vail.

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FONDO DE OJO A LA LUZ DE SODIO (Ocular fundus by sodium light). By Justo Lijo Pavia. Paper covers, 200 pages, 101 illustrations, mostly black and white reproductions of fundus photographs. Published by "El Ateneo," Buenos Aires, 1941. Price not stated.

After an explanation of the structure of the sodium diagnostic lamp, and a description of the technique of fundus examination with this light, the author describes the details observed by ordinary light, by redfree light, and by sodium light, in cases of the following clinical conditions: retinal detachment, medullated nerve fibers, degenerative lesions of the macula, early lesions of the macula, retinal tears, retinal changes of arterial hypertension, chronic glaucoma, choroiditis, recent and old ocular traumatisms, retinal lesions of hypophyseal origin, and optic-nerve atrophy.

A final chapter analyzes the results obtained by the three methods in each of these cases. The author has been able to find in the literature only 43 references to articles previously published on this subject. Of these articles, 16 are by Lijo Pavia himself, either singly or in association with collaborators.

Beneath each fundus illustration is a full explanation of the details observed by means of the sodium light. With these textual explanations, the monograph offers a useful contribution to the literature of diagnosis of fundus conditions. The circular issued by the publisher of the volume speaks of the "high degree of perfection not only as to the clearness of the engravings," etc. Unfortunately, however, the majority of the fundus illustrations hardly live up to the publisher's praise of his own work, and, apart from the careful description appended by the author to each photograph, would afford the reader little information concerning the conditions observed by the author.

W. H. Crisp.

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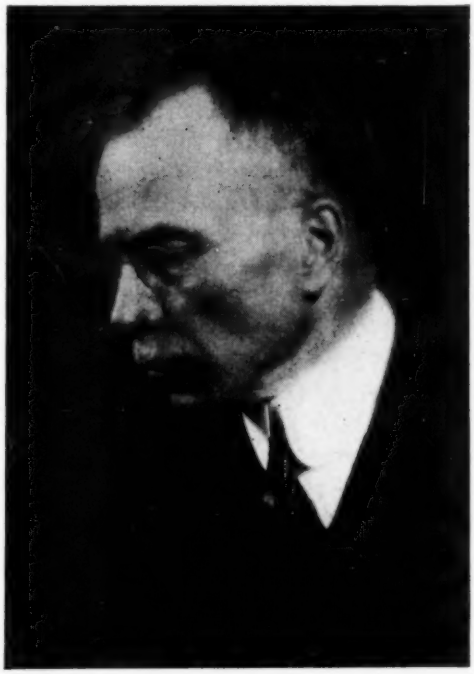
# OBITUARY

## CASEY A. WOOD
## 1856-1942

On January 26, 1942, there died in California, one who had created and occupied a unique position in the ophthalmologic and scientific world! *Casey Albert Wood*—Student; Practitioner; Linguist; Bibliophile; Editor; Traveler; Author; Friend.



Dr. Wood was born at Wellington, Ontario, November 21, 1856, of American lineage and English ancestry. In his

early schooling, besides receiving with great care an all-around English education, he acquired both French and German, which fitted him for his later education and favored in no small degree his ability to become conversant with other languages. He entered on his medical studies at Bishop's College, Montreal, receiving instruction in clinical medicine and surgery at the Montreal General Hospital, and graduating in 1877. After passing the examinations for admission to the College, he became a licentiate of the College of Quebec, and opportunities to attend lectures at McGill were afforded him.

He practiced general medicine and surgery for several years in Montreal, and held the chairs of chemistry and pathology at Bishop's College. Notwithstanding these successes he decided that he would make a specialty of ophthalmology. After spending several months at the New York Infirmary, he went on to Berlin, thence to Vienna, Paris, and London; but the greater part of this period was given to study and assisting at the Royal London Ophthalmic—old "Moorfields." The memories of the associations begun during that period continued vividly throughout his life.

On returning to America, in 1882, Dr. Wood settled in Chicago, where he rapidly acquired a large and lucrative practice and filled numerous positions in both ophthalmologic and general medical associations. It was not long before he became one of the most prominent members of the profession in the Middle West, both because of his practice and his contributions to the journals, and by his active participation in the affairs of the societies, general and special. In 1904, he was appointed Professor of Ophthalmology at the University of Illinois, which chair he held until 1925; and in 1920 he assumed the professorship at Northwestern University. During three years he efficiently served as Editor of the Ophthalmic Record, the Annals of Ophthalmology, and, when these ceased to exist, he helped to found the present American Journal of Ophthalmology. While editor of these journals Dr. Wood assumed charge of the departments derived from French, Italian, German, and other languages. His contributions to ophthalmology were numerous, original, and valuable, especially his "Toxic amblyopia" (1896) which continues as a classic in ophthalmic literature. In 1907 was published "The commoner diseases of the eye," in 1909 "A system of ophthalmic therapeutics," in 1911 "A system of ophthalmic operations," and, later the monumental "American encyclopedia of ophthalmology," to which he was chief contributor and which he edited.

From 1908, Dr. Wood had held the rank of Lieutenant in the Medical Reserve Corps of the Army, but when, in 1917, the United States entered the war, he came actively into responsible positions. His first assignment, in November, 1916, was that of examining aviators. As Major he was given charge of the air service in Chicago, and midsummer, 1917, found him in charge of Head Surgery at Camp Sherman, Ohio. Later he was ordered to Washington to take charge of a section in the Division of Physical Reconstruction. This last assignment afforded him the opportunity to edit "Carry on," the "Reconstruction" magazine. Then came official association with the Red Cross in the care of disabled men, and the Institute for the Blind. A distressing period of ill health prevented his undertaking an assignment for service abroad. On his recovery he was assigned to the office of the Surgeon General to prepare the medical and surgical history of the war. While connected with the Surgeon General's office, he was engaged on the

"History of hospitals." After his discharge with the rank of Lieutenant Colonel, he was reëngaged to complete the "History of hospitals"; finally he was discharged, in January, 1920, with the rank of Colonel.

During his residence in Washington, Dr. Wood was one of the committee to prepare the volume to commemorate the seventieth birthday of Dr. Osler. To signalize their devotion to Dr. Osler, he and Col. Fielding Garrison prepared "A physician's anthology of English and American poetry," a collection of poems and verses which they deemed typical of Osler's personality or such as would have delighted Sir William had he lived to enjoy this birthday tribute to him, in the attractive volume published by the Oxford Press. It was at McGill that Wood had come under the influence of Dr. Osler; indeed, Wood was one of Osler's first pupils. Their friendship continued with increasing intimacy until Sir William's death.

In his youth Casey Wood became interested in the natural sciences, particularly ornithology, and that interest was intensified after entering the field of ophthalmology, especially by his inquiring into the visual function of animals and birds. From time to time he made numerous contributions to the literature relating to the nature and habits of birds, and, in 1917, appeared an outstanding folio, "The fundus oculi of birds," illustrated by 50-odd colored plates. This work is a record of his painstaking studies of the ocular structures of living and dead birds. It is well known to ornithologists, and serves as a companion piece to Lindsay Johnson's "Mammalian fundus" (London, 1901).

As might be expected Dr. Wood had accumulated a comparatively large library of ornithologic works, a collection which he, in 1920, presented to McGill University in honor of his wife, who had always been interested in birds.

In his efforts to complete work he had had in hand on the "Eyes and eyesight of birds," after his retiring from practice, Dr. Wood joined a party of naturalists accompanying William Beebe, on their way to northern South America. Wood's object was to collect specimens of birds in his endeavors to solve the mysteries of how we see. Anticipating the vast flocks of birds wintering there, they landed at British Guiana, intending to camp up the Essiquibo River. There Wood and his fellow workers were rewarded by securing 8,000 or so heads, which they preserved for study. On their return to the States they began the serious study of the specimens, but Wood soon found himself balked by a lack of analytical knowledge of ornithology. Accordingly, he decided to go to England where he might pursue the study undisturbed. On applying at the British Museum for a catalog of ornithologic works, he was nonplused when told that the Library had not maintained a separate catalog of that subject. He was, therefore, compelled to search out from the general catalog the ornithologic titles, with the result that Casey Wood made for the Museum its first catalog. This incident is in keeping with his industry as an indefatigable bibliophile and donor in compiling "An introduction to the literature of vertebrate zoology" from a group of libraries at McGill University. This work was published by the Oxford Press in 1931. Wood was then associated with the Smithsonian Institute, Washington, D.C., as "Collaborator, Division of Birds."

Dr. Wood had been impressed, as who is not, by the marvelous and extraordinary visual powers of fowls of the air, especially of the rapacious vultures, buzzards, and such, which, when high in the air at more or less great distances away from

their prey, could, in an incredibly brief time, alight unerringly, giving evidence of an acuteness of sight or some other inherent power, not yet explicable. He had hoped he might find in the minute anatomy of the eye of birds some element that might be the analogue of similar elements undeveloped in the human eye.

Casey Wood was not only a scientist seeking facts about the structure and function of birds, he had been all his life a true lover of birds, and had an uncanny power over them, even in the wilds of the jungle. In visiting the aviary at the Zoological Gardens, as Dr. de Schweinitz and I, too, attested, as he would approach the cage, it was observed that a drooping, disconsolate individual, shrinking in the corner, would, as by magic, rouse itself and come fluttering to the bars chirping and calling as it might have done had it been in its native forests.

Wood was a great traveler. When planning to visit a specified distant country, he would arrange to visit the islands, or lands, on the way. So, as on the voyage to Guiana, he stopped at all the islands of the Caribbean. And to and from New Zealand and Australia, and the Philippines, all stops possible were made. For months he traveled in Ceylon and India. On the voyage to Italy he stopped wherever he might. In these travels he indulged his innate passion for book collecting, especially in medical history and kindred subjects. Happily his impressions and memories of the delightful visits were not destroyed by the devastations which have occurred since his death.

While in Italy, Wood devoted himself to the writing up of the items which had accumulated in his travels. In Rome he enjoyed the hitherto all but excluded privilege of freedom of the Vatican Library. It was his rare fortune to have been allowed to consult works, many of which he believed had not been taken out of their cases since their deposit the century or more previously. Arabic and medieval works engaged his attention. In 1929 appeared his translation and editing of "De oculis" of Benevenutus Grassus of Jerusalem, Ferrara, 1474, the first printed book on ophthalmology, of which at one period there were known to be extant only five copies, and of these one is possessed by the College of Physicians of Philadelphia.

In 1936 he issued "The memorandum book of a tenth-century oculist," the "Tadhkirat" of Ali ibn Isa, of Baghdad (940-1110). And, in recent years he was engaged on "The falconry of Frederick II," which he had the keen delight to have given to the printer a few days before his final illness.

In Ceylon, he gathered examples of the medical and surgical materials, chiefly the sheaves of palm leaves which served as medical books to the native doctors—the so-called Sinhalese "Olas." Through the generosity of their collector, McGill and other medical museums, including the College of Physicians, Philadelphia, now possess these Olas and the metal styluses with which these leaves were written.

Though Dr. Wood always found much to occupy him while in Europe and elsewhere, it was his delight every two years or so to return for a sojourn in California. After Italy entered into this World War II, it was to sunny California he returned, with all his belongings, in 1940.

In 1905 McGill granted him the degree of M.D. and of LL.D. in 1922. Few alumni have been more generous than he. In addition to the ornithologic collection, he presented an intrinsically and historically valuable collection of ophthalmologic works and instruments. This may be regarded as one of the most important in the world, particularly as to periodicals. To the Osler Library he sent several rare manuscripts.

Dr. Wood had the genius of friendship, always loyal and faithful; in all his activities he drew others to himself. In professional associations he so attracted others that they became not merely colleagues but friends. His kindliness served to inspire younger men to a degree of diligence equal to his own industry. He was generous in criticism, and, when assaying contributions as editor, never failed to give credit to the full, always accepting the enthusiasms of his fellow workers as just and worthy elements in the expositions of the subjects in hand. The dinner arranged for him on January 19, 1920, by the Chicago Ophthalmological Society upon his retirement from active practice, demonstrated the regard his fellows had for him because of these qualities.

In his travels it was his good fortune to meet those who became his friends. His correspondence was enormous, and he was one who could maintain it. The writers were scattered all over the world; they seemed to understand fully each and all of Dr. Wood's interests, which they fed and supplied materials for without stint, while he could manifest concern over those of his correspondents. Several times because he wished to keep his intimate friends informed as to his experiences in travel and study he prepared many-paged manuscripts which were sent from one to another. As these communications contained items of scientific interest, certain of the manuscripts have been preserved in the McGill Library. To the end of his days, despite the variety of Dr. Wood's interests, he was primarily an ophthalmologist, seeking information about the science or items that either had grown out of the development of ophthalmology or tended to increase the usefulness of it.

In his travels Dr. Wood was always accompanied by Mrs. Wood, who was an enthusiastic lover of the out-of-doors as well as the possessor of that social graciousness which made her so charming a companion. They were without children. His ashes are to repose in Mount Royal Cemetery, Montreal.

Burton Chance.

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## CORRESPONDENCE

### Corneal sutures

March 26, 1942

Editor,
American Journal of Ophthalmology:

The description of the manner of using corneal sutures in an operation for cataract on an eye which has undergone a corneoscleral trephining or other filtering operation, as described by Dr. John McLean in the February number of the American Journal of Ophthalmology, is an interesting instance of how different observers will arrive at the same conclusion in the study of a problem. To one who uses the suture in cataract surgery, it suggests itself as a logical solution. If one suture is used it is almost always placed at "12 o'clock," and if so placed in an eye that has had a filtering operation done at that position, it would be difficult to place it properly, on account of the presence of the scar of the previous operation. Since multiple sutures are frequently employed, it seems natural to use two under the circumstances, and place one on each side of the filtering scar. Since the operation for cataract after glaucoma is quite common, it was soon apparent to me that an incision through the filtering scar would seriously disturb it and very likely abolish its filtering properties. So the solution which Dr. McLean has described must have occurred to other operators, as it had to me. For about 20 years it has been my habit to perform the operation in such cases

just as he described it, and I can add my testimony to his, that it is a satisfactory way to handle such a situation. I remember discussing the location of the incision with Dr. Walter Lancaster at least as long ago as that, but as he showed no enthusiasm about the suture, our views agreed only as to the best location for the incision. To those who have not followed this plan, Dr. McLean's description and illustration will be a useful introduction to it.

(Signed)
E. C. Ellett.

## ERRATA

In the March, 1942, issue of the Journal, page 354, column two, tenth line from the bottom of the page, substitute *of* for to: ". . . a size correction of 2 percent at 90 degrees. . . ."

In the April, 1942, issue of the Journal, page 406, second column, eighth line from the bottom, Kreutsch should read Kreutztisch.

In the April, 1942, issue, page 443, first column, fourth line from the bottom, lenticular should read epithelial.

# ABSTRACT DEPARTMENT

EDITED BY DR. WILLIAM H. CRISP
ASSISTED BY DR. GEORGE A. FILMER

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

## CLASSIFICATION

1. General methods of diagnosis
2. Therapeutics and operations
3. Physiologic optics, refraction, and color vision
4. Ocular movements
5. Conjunctiva
6. Cornea and sclera
7. Uveal tract, sympathetic disease, and aqueous humor
8. Glaucoma and ocular tension
9. Crystalline lens
10. Retina and vitreous
11. Optic nerve and toxic amblyopias
12. Visual tracts and centers
13. Eyeball and orbit
14. Eyelids and lacrimal apparatus
15. Tumors
16. Injuries
17. Systemic diseases and parasites
18. Hygiene, sociology, education, and history
19. Anatomy, embryology, and comparative ophthalmology

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## 6

### CORNEA AND SCLERA

Miklos, A. **Destructive corneal ulcer and its treatment.** Graefe's Arch., 1940, v. 142, pt. 4, pp. 459-466.

Four cases of destructive ulcer of the cornea are reported. All of the patients were over 54 years of age and all had hypertension. In each case the ocular disease began in the limbus as a grayish-white infiltrate and could not be differentially diagnosed at this stage. Progress of the disease was very rapid and the ulceration developed at the edges and the center of the cornea. The ulcer had a non-infiltrated base, and the border between the healthy tissue and the ulcer was sharp and grayish white, with somewhat undermined edges. The unaffected cornea remained transparent but its sensitivity was decreased. This type of ulcer differs from Moorens ulcer in that there is no vascularization and its progress is more rapid. Conservative treatment is useless. The author has found that a conjunctival flap produces favorable results. (Kreiker's method.) Frances C. Cogan.

## 7

### UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Basar, Irfan. **Epithelial cyst of the anterior chamber.** Türk Oft. Gazetesi, 1940, v. 3, pt. 5, p. 252. (French abstract, p. 294.)

The cyst appeared seven years after cataract extraction and was presumed to have arisen from a downgrowth of epithelium from the corneal section. X-ray treatment was recommended.

George A. Filmer.

Beaudoux, H. A. **Congenital ocular development.** Jour. Internat. College of Surg., 1941, v. 4, Oct., p. 432.

This article reports the case of a seven-months-old child with congenital atresia of the pupil. Optical iridectomy, under ether anesthesia, was successfully performed on both eyes at the same time. F. M. Crage.

Berens, C., Rothbard, S., and Angevine, D. M. **Cultural studies on patients with uveitis and other eye diseases.**

Amer. Jour. Ophth., 1942, v. 25, March, pp. 295-301; also Trans. Amer. Ophth. Soc., 1941, v. 39, p. 310. (4 tables, bibliography.)

Duggan, W. F. **Choroidosis centralis serosa. Diagnosis, pathologic physiology and therapy.** Arch. of Ophth., 1942, v. 27, Jan., pp. 123-138.

The term choroidosis centralis serosa is proposed for lesions at or near the macula which are due to localized subretinal edema. The usual presenting symptom is a central blurring of vision, and micropsia and transitory hyperopia are likely to occur in patients who have only a slight depression of central visual acuity. An elevation of the retina of from 0.5 to 3 D. or more and the presence of a scotoma only for blue, or larger for blue than for white or for red test objects, are the important objective findings. Disciform degeneration of the macula differs only in degree from the mild lesions of choroidosis seen in young adults. The retinal changes sometimes found in cases of choroidosis centralis serosa are the most obvious but the least important of the ophthalmoscopic findings. These changes are probably due to the passage of a histamine-like substance from the area of subretinal edema into the retina. The primary choroidal lesions should be differentiated from the lesions of central angiospastic retinopathy. Although the etiologic factors and the therapy are the same for both types of lesion, choroidal angiopathy gives a better prognosis than retinal angiopathy because the rod-and-cone cells seem able to withstand anoxia for a relatively longer time than the retinal ganglion cells. All substances are possible etiologic agents which in virtue of their presence (histamine, epinephrine, nicotine) or their absence (acetylcholine, cevitamic acid, some factors of the vitamin-B complex, and possibly estrogen) may cause either arteriolar spasm or increased capillary permeability or both. The immediate result is tissue anoxia. These vascular changes and the resulting tissue anoxia are the final common pathway whereby a number of apparently unrelated etiologic agents may produce the same pathologic lesion. Lesions differ quantitatively rather than qualitatively and represent varying degrees of Ricker's stages of prestasis, peristasis, and stasis. Treatment with vasodilators to increase the supply of oxygen-containing blood to the anoxic capillaries and tissues has a sound physiologic basis. If there are vitamin or other deficiencies, patent vascular channels enhance the opportunity for the needed factors to reach the morbid tissues.

J. Hewitt Judd.

Gözberk, Rifat. **A case of tuberculoma of the choroid.** Türk Oft. Gazetesi, 1939, v. 3, pt. 2, p. 65. (French abstract, p. 120.)

The left eye of a three-year-old boy was enucleated because of what appeared to be a glioma. Microscopic examination showed the tumor to be a tuberculoma of the choroid.

George A. Filmer.

Mártinez, Luis, Jr. **A case of severe bilateral uveitis (syndrome of Vogt-Hirata).** Anales de la Soc. Mexicana de Oft. y Oto-Rino-Laring., 1941, v. 16, Sept.-Oct., p. 273.

Martinez reports an instance of rapidly progressive, severe, bilateral uveitis in a 20-year-old woman. Blindness followed shortly, accompanied by graying of the eyelashes, alopecia of the scalp, and splitting and discolora-

tion of the hair—a slightly atypical example of Vogt-Hirata disease.

Eugene M. Blake.

Sander, Muzaffer. **Early biomicroscopic diagnosis of a case of sympathetic ophthalmia.** Türk Oft. Gazetesi, 1939, v. 3, pt. 4, p. 222. (French abstract, p. 242.)

"Several days" after an injury to one eye, a young soldier complained of intermittent pain and visual disturbance in the other eye. Slitlamp examination revealed evidence of uveitis.

George A. Filmer.

Sorsby, Arnold. **Observations on the clinical pathology of fundus lesions.** Irish Jour. Med. Science, 1941, Nov., pp. 573-591. (See Section 10, Retina and vitreous.)

## 8

## GLAUCOMA AND OCULAR TENSION

Allen, T. D., and Ackerman, W. G. **Hereditary glaucoma in a pedigree of three generations.** Arch. of Ophth., 1942, v. 27, Jan., pp. 139-157.

Hereditary glaucoma is reviewed as to average age at onset, tendency to anticipation, sex incidence, sex transmission, size of cornea, depth of anterior chamber, association with myopia, type of glaucoma, associated conditions, gonioscopic findings, color of iris, heredity and race, treatment (medical and surgical), and prognosis. The pedigree reported shows one individual affected in the first generation, two in the second, and four in the third. This type of glaucoma is of a simple dominant type and is not sex-linked. The ratio of affected to nonaffected members was seven to eight. No evidence of consanguinity was present. The average age at onset was 11.6 years. Myopia was present in two of the four patients whose refractive error could be determined. Miotics alone were insufficient but a combination of medical and surgical therapy gave the best results. Early operation, before extensive damage to vision has occurred, is important. Goniotomy gave the best results in this group of cases. The author's technique of goniotomy is described. In the discussion it was reported than an additional member of the family, an eight-year-old girl belonging to the third generation, had been found to be affected. The tension was 30 mm. in each eye and was not affected by miotics but was entirely controlled by a single goniotomy in each eye.

J. Hewitt Judd.

Clarke, S. T. **The use of doryl in the treatment of glaucoma.** Amer. Jour. Ophth., 1942, v. 25, March, pp. 309-316. (One formula chart, 3 tables, references.)

Glees, M., and Ried, A. **Contribution to the question of heredity in glaucoma.** Graefe's Arch., 1940, v. 142, pt. 4, pp. 495-502.

In a family of five generations with hereditary glaucoma simplex there was a total of 94 members, 24 of whom died very young, leaving 70 of interest to this report. Of these 33 were men and 34 women. There were 15 known cases and two likely cases of glaucoma simplex occurring in seven out of 25 separate families. The glaucoma was a dominant hereditary characteristic. It occurred about equally in males and females. The average age of occurrence was between 20 and 25 years and there was no apparent anticipation in the successive generations. The form and course of the disease did not change. There were no other congenital ocular defects noted. In most members of the

family, measurements of the corneal diameter came within normal limits. Of the glaucomatous eyes 54 percent were myopic and most of them had deep anterior chambers.

Frances C. Cogan.

Purtscher, E. **Fetal hydrophthalmos with malformation of the orbit due to amniotic bands.** Graefe's Arch., 1940, v. 142, pt. 4, pp. 453-458.

A case of severe malformation of the skull in a six-months still-born fetus. There was an exencephaly and oblique development of the right orbit and a hydrophthalmos of the right eye which, according to the author, was the result of occlusion of the orbital veins by amniotic bands. There was also evidence of retardation of growth in this eye. The author concludes that this was a case of microphthalmos due to a nutritional disturbance with secondary stretching due to the hydrophthalmos. The left eye was normally developed.

Frances C. Cogan.

## 9

## CRYSTALLINE LENS

Allende, F. P. **Study of light perception and projection with a narrow beam of light.** Arch. of Ophth., 1942, v. 27, Jan., pp. 164-166. (See Section 1, General methods of diagnosis.)

Blumenthal, C. J. **A method of treating sepsis after cataract extraction.** South African Med. Jour., 1941, v. 15, May 10, p. 171.

In a frail woman of 68 years corneal-surface dullness was noted at the first dressing on the day following a simple cataract extraction with chamber irrigation. The patient was put on "M & B 693"—one tablet every four hours. Because it upset her the medication was continued cautiously. There was hypopyon and the eye looked hopeless. Under local anesthesia and after removal of a suture the anterior chamber was irrigated with a mixture of 5-percent mercurochrome and 10-percent glycerine. The chamber structures stained intensely and the subsequent chemosis was enormous. The eye cleared in four months and after diathermy for secondary tension and a needling, corrected vision reached almost 6/9 and J.2.

F. M. Crage.

Gözberk, Rifat. **Cataract formation in two children with pellagra.** Türk Oft. Gazetesi, 1939, v. 3, pt. 1, p. 7. (French abstract, p. 59.)

Two children, one 11 and the other 8 years old, developed typical pellagra after having been on deficient diets. One developed unilateral and the other bilateral cataract which progressed to maturity. The pellagra responded to dietary treatment, and the cataracts were operated upon.

George A. Filmer.

Kirby, D. B. **Procedures in intracapsular cataract extraction.** Amer. Jour. Ophth., 1942, v. 25, March, pp. 269-277; also Trans. Amer. Ophth. Soc., 1941, v. 39, p. 115. (Bibliography.)

Knapp, Arnold. **Operative treatment of congenital subluxation of the lens.** Arch. of Ophth., 1942, v. 27, Jan., pp. 158-160; also Trans. Amer. Ophth. Soc., 1941, v. 39, p. 83.

The operation of choice is discission with two knife needles, one of which is introduced through the sclera just posterior to the limbus at a point opposite the free border of the lens. The free border of the lens is punctured at this point, and the instrument is held firmly in place while the other knife needle is introduced through the sclera

just below the site of the previous puncture and perforates the lens capsule at the same point as the first needle. By approximating the two handles of the knife needles and passing one handle over the other, the two knife blades are separated and enlarge the opening made in the capsule. The needles are then cautiously extracted in turn. When the opacification and absorption of the lens comes to a standstill, the procedure has to be repeated. Shrinkage of the lens results in a clear aphakic area. The case of a girl, aged ten years, with bilateral subluxation of the lens is reported. A simple discission was first tried on one eye without success. A double-needle operation was performed a week later, and repeated after three weeks. An iridocyclitis followed by a neuroretinitis developed subsequent to an upper respiratory infection. However this subsided and the vision gradually increased to 20/20— and the eye seemed perfectly healthy.

J. Hewitt Judd.

Márquez, Manuel. **Considerations of "modern" and "ancient" methods of cataract extraction.** Anales de la Soc. Mexicana de Oft. Oto-Rino-Laring., 1941, v. 16, Sept.-Oct., p. 253.

The author points out that that which we are wont to call modern—the intracapsular extraction of cataract—was practiced by the earliest operators, such as Daviel, St. Yves, and Petit. He discusses peripheral iridectomy, the use of sutures, akinesia, the conjunctival flap, and other features of the operation and inclines to reject most of these except under special conditions. He favors the shortest and simplest procedures and deplores too much handling of tissues and complicated maneuvers.

Eugene M. Blake.

Mielke, S. **Warm current in the lens.** Graefe's Arch., 1940, v. 142, pt. 4, pp. 474-476.

In the cataractous fluid lens of a rabbit eye which contained a foreign body, cholesterine crystal-like particles were observed to move from above to below. This movement was considered by the author to be the result of a current caused by temperature differences in the lens, similar to that found in the aqueous.

Frances C. Cogan.

Sathaye, V. D. **Ectopia lentis.** Indian Jour. Ophth., 1941, v. 2, Jan., p. 1.

Sathaye reports two cases of dislocated lenses in a brother and sister, and discusses the incidence, etiology, and complications of the condition. The treatment preferred by the author is a preliminary iridectomy followed two or three months later by a loop extraction of the lens.

Edna M. Reynolds.

## 10

### RETINA AND VITREOUS

Balaban, Salâhaddin. **A rare case of Coats's exudative retinitis.** Türk Oft. Gazetesi, 1939, v. 3, pt. 2, p. 84. (French abstract, p. 122.)

Description of the case.

Bengisu, N. **A case of unilateral papilloretinitis associated with an infected tooth.** Türk Oft. Gazetesi, 1939, v. 3, pt. 1, p. 16. (French abstract, p. 61.)

A 10-year-old girl with reduced vision in one eye was found to have papilloretinitis with macular exudates. Dental examination revealed infection around a milk tooth. Removal of the tooth was followed by complete subsidence of the eye condition.

George A. Filmer.

Campbell, Ian. **Dark adaptation and miners' nystagmus.** Brit. Med. Jour., 1941, Nov. 22, p. 726.

Definition and historical references are mentioned. Recent work done on the association of vitamin-A deficiency and night blindness led the author to consider the association of diet and miners' nystagmus.

In the miners selected, dark-adaptation tests gave indication of vitamin-A deficiency. Administration of vitamin A considerably improved the dark adaptation. An optimum supply of this vitamin is strongly recommended for the working vision and safety of miners. F. M. Crage.

Crozier, W. J., and Wolf, E. **Theory and measurement of visual mechanisms. 7. The flicker-response function outside the fovea.** Jour. Gen. Physiology, 1941, v. 25, Nov. 20, p. 293.

This article is a highly technical study of rod-and-cone response in the extrafoveal region. (Tables, graphs.) F. M. Crage.

Goar, E. L. **Retinal hemorrhages following the ingestion of sulfathiazole.** Amer. Jour. Ophth., 1942, v. 25, March, pp. 332-333. (2 case reports.)

Gördüren, Süreya. **Detachment of the retina and accidents in general.** Türk Oft. Gazetesi, 1940, v. 3, pt. 5, p. 255. (French abstract, p. 295.)

A discussion of the various forms of trauma which may cause retinal detachment. George A. Filmer.

Ocampo, Geminiano de. **Periphlebitis and phlebitis retinae.** Amer. Jour. Ophth., 1942, v. 25, March, pp. 278-283. (2 illustrations, references.)

Rados, Andrew. **Bilateral uveitis with associated detachment of the retina.** Arch. of Ophth., 1941, v. 26, Oct., pp. 543-552.

The author reviews the literature and the findings in his two previously reported cases. Bilateral uveitis with retinal detachment (Harada's disease) and bilateral uveitis associated with alopecia and poliosis, and occasionally vitiligo and partial deafness, are severe nontraumatic forms of uveitis, while sympathetic uveitis is the most severe type of traumatic uveitis. Clinically, sympathetic uveitis differs from the first two conditions in that it occurs only after perforating injury except in cases of necrotizing melanosarcoma. Of the nontraumatic syndrome, bilateral uveitis, associated with symptoms involving the integument and the hair, should be sharply differentiated from bilateral uveitis accompanied by retinal detachment, since alopecia and poliosis do not figure as an integral part of Harada's disease. J. Hewitt Judd.

Riggs, L. A. **Continuous and reproducible records of the electrical activity of the human retina.** Proc. Soc. Exper. Biol. and Med., 1941, v. 48, Oct., pp. 204-207.

The author describes a new method of recording action potentials of the retina in which the two chief technical difficulties are eliminated by (1) coating the central portion of a contact lens with black enamel, leaving an opening of the desired aperture at the exact center of the lens; and (2) by cementing the electrode into a hole in the contact lens. Plinio Montalván.

Sallmann, L. **Hydrogel qualities of the vitreous.** Arch. of Ophth., 1941, v. 26, Nov., pp. 770-788.

These experiments were conducted on especially protected preparations of vitreous in which the escape of capil-

lary fluid was prevented by leaving in place the ciliary body, the posterior part of the lens capsule, and a thin layer of the optic nerve with the retina. It was found that the marked volume changes of the vitreous in strongly alkaline and acid ranges were not reversible, so that the pH curve of the vitreous is different from that of a hydrogel. Expansion which occurs in Ringer's solution and a solution of 0.9-percent sodium chloride is not a result of osmotic processes, nor of increased molecular concentration due to postmortem decomposition, as shown by determinations of the freezing point. Hydrating and dehydrating neutral salts give the effect of the lyotrope series of anions and act on the vitreous as on gelatin, with the shrinkage and swelling produced by these salts being reversible. Alcohol in concentrations of more than 40 percent causes shrinkage of the vitreous, which is reversible as in hydrogels. At a physiologic pH, desalinated vitreous shrinks in low concentrations of neutral salts. The degree of this shrinkage increases with the valance of the cation. In a solution of 0.9 percent sodium chloride the vitreous may regain the volume lost by pressure, therefore as a whole it is elastic to some degree. The vitreous preparations expand in a solution of 0.9 percent sodium chloride against a pressure of 31 mm. of water exerted for four hours. The mechanism of volume changes in the vitreous is one of the basic problems in the physiology and pathology of the eye because of the possible relation to changes in tension of the eye and to certain displacements of intraocular structures. Such volume changes are the expression of the intake and output of fluid. The waterbinding power of the vitreous may play an important role in the complexity of regulating factors and may determine the state of turgescence, deturgescence and turgescence pressure. These experiments were conducted in order to help clarify the connection of water-binding to volume changes. Since the interrelation of the vitreous constituents and the architecture of the fibrils is not greatly disturbed in these preparations, it is possible to achieve a better understanding of volume changes and their mechanism of turgescence pressure and of elasticity. J. Hewitt Judd.

Scholz, R. O. **Angioid streaks.** Arch. of Ophth., 1941, v. 26, Oct., pp. 677-695.

This review is based on the study of 182 cases of angioid streaks described in the literature and six cases from the Wilmer Institute reported here. The findings are analyzed as to country, race, sex, age, onset of the disease, visual acuity, visual fields, color, size, and distribution of the streaks, other associated intraocular conditions (pseudoxanthoma elasticum and osteitis deformans), familial occurrence, prognosis, differential diagnosis, and pathology. (Fundus photographs, photomicrographs, drawings, bibliography.) J. Hewitt Judd.

Sorsby, Arnold. **Observations on the clinical pathology of fundus lesions.** Irish Jour. Med. Science, 1941, Nov., pp. 573-591.

A large number of fundus conditions are discussed in detail, both as regards the clinical background and the ophthalmoscopic appearance. The author concludes that heredity is a most significant etiologic factor in the pathology of fundus lesions, and that a great number of fundus lesions are variants and intermediate stages of a continuous process. T. E. Sanders.

Stern, K. G., and Melnick, J. L. **The photochemical spectrum of the Pasteur enzyme in retina.** Jour. Biol. Chemistry, 1941, v. 139, May, p. 301.

In this technical outline the Pasteur enzyme is defined as the heavy metal-containing, thermolabile agent which catalyzes the inhibition of fermentation by molecular oxygen, a phenomenon known as the Pasteur reaction. The spectrum of the enzyme in rat retina has been charted by Warburg's photochemical method. Although the Pasteur enzyme in retina differs from the respiratory ferments of the same tissue, of yeast, and of Acetobacter in its affinity for oxygen and carbon monoxide, the general pattern of its spectrum reveals it to be a pheohemin proteid like the respiratory ferments in yeast and Acetobacter. (14 references.)

Ralph W. Danielson.

Verhoeff, F. H. **Moore's subjective "lightning streaks."** Amer. Jour. Ophth., 1942, v. 25, March, pp. 265-268; also Trans. Amer. Ophth. Soc., 1941, v. 39, p. 220.

Wittkower, E., Rodger, T. F., Scott, G. F., and Semenoff, B. **"Night-blindness," a psycho-physiological study.** Brit. Med. Jour., 1941, Nov. 1, pp. 607-610.

A series of 52 unselected soldiers complaining of night blindness were examined ophthalmologically, psychiatrically, and by dark-adaptation tests. Of 34 thoroughly studied jointly, 22 had no relevant disturbance of dark adaptation on testing, but nearly all suffered from severe psychiatric disorders of a specific type. Of the remaining 12 patients with definite disturbance of dark adaptation, one was a case of retinitis pigmentosa, and another of hereditary night blindness; in practically all of the others, although their psychiatric disorders appeared to be less severe than in the main group, severe disturbances of eye function, generally regarded as "hysterical," were found. The authors conclude that most cases of night blindness seen in Britain at present are probably of psychologic origin, and that there is no evidence of vitamin-A deficiency being a factor in the series studied.

T. E. Sanders.

## 11

### OPTIC NERVE AND TOXIC AMBLYOPIAS

Balaban, Salâhaddin. **A rare case of coloboma of the optic nerve.** Türk Oft. Gazetesi, 1940, v. 3, pt. 5, p. 263. (French abstract, p. 296.)

A case report.

Bengisu, Naci. **Sudden monocular blindness in a case of generalized osteitis fibrosa.** Türk Oft. Gazetesi, 1940, v. 3, pt. 5, p. 245. (French abstract, p. 293.)

A young man with generalized Recklinghausen's disease of the bone rapidly lost the vision of one eye. X-ray examination showed condensation of bone in the base of the skull with obliteration of the optic canal and resulting optic atrophy. George A. Filmer.

Brumm, L. P. **Bitemporal consecutive optic atrophy with drusen of the optic papilla.** Amer. Jour. Ophth., 1942, v. 25, March, pp. 330-332. (One illustration, references.)

Costen, J. B. **Retrobulbar neuritis in relation to sinus disease.** Surg., Gyn., and Obstet., 1942, v. 74, Feb. 16, p. 594.

The author presents six case reports and a table of 22 cases. He concludes that even though the question should remain open because of so many quali-

fying factors, surgery of diseased sinuses seems to be indicated when the condition occurs in association with retrobulbar neuritis. The use of laminagrams is valuable in addition to the X-ray study of posterior sinus disease. (21 references.)

Ralph W. Danielson.

Espíldora Luque, C., Santos Galmez, E., and Casorzo, L. **Systemic and retinal arterial hypotension in tabetic and glaucomatous papillary atrophy.** Arch. de Oft. de Buenos Aires, 1940, v. 15, March, p. 136.

The authors studied the incidence of tabetic and glaucomatous atrophy in relation to retinal and systemic arterial hypotension in order to estimate the validity of Lauder and Sobansky's pathogenic theories. According to the latter observers the basic factor in the mechanism of production of atrophy in tabes and pseudoglaucoma is a low diastolic pressure of the retinal arteries. When this diastolic pressure is lower than the intraocular pressure, the faulty irrigation of the optic nerve brings about a nutritional deficit with resulting degeneration and atrophy of the nerve fibers.

For the purpose of their study, the authors selected 12 cases of tabes with definite optic atrophy in various stages of evolution; 12 cases of tabes in which a careful investigation revealed no functional or anatomic involvement of the optic nerve were used as clinical controls. The systemic blood pressure, the retinal blood pressure determined with Bailliart's ophthalmodynamometer, and the intraocular pressure measured with the Schiötz tonometer were the basis of this study. The relationship between the general and retinal blood pressures was not a constant one. Low systemic diastolic pressure was found in cases with normal or high retinal diastolic pressure. In the control series (tabes without optic atrophy) the retinal blood pressure was, in every instance, normal or increased, thus confirming Lauber's conclusions in this connection. In the series of cases with optic atrophy, while low general diastolic pressure was quite prevalent, the retinal diastolic pressure was normal or elevated and only one case showed a retinal diastolic pressure below the intraocular pressure. This is in disagreement with Lauber's theory.

In an attempt to elucidate the role of low retinal pressure in the production of optic atrophy, twenty cases of aortic insufficiency with markedly low retinal pressure were selected at random. In 15 cases the retinal diastolic pressure was below the intraocular pressure. Careful examination revealed partial optic atrophy in only two cases, one of which was also suffering from syphilitic meningitis and the other was a clear-cut case of tabes.

The authors conclude that low retinal diastolic pressure is in itself insufficient to produce optic atrophy. It may be a predisposing cause, but other etiologic factors, such as syphilis, play a preponderant role. (Tables, bibliography.)

Plinio Montalván.

Gördüren, Süreyya. **Clinical and therapeutic relationship between the eye and nasal cavity.** Türk Oft. Gazetesi, 1939, v. 3, pt. 3, p. 131. (French abstract, p. 198.)

A general elaboration of the subject and a discussion of two cases. In one, operation on infected frontal sinuses was followed by subsidence of a bilateral neuroretinitis. In the other, retrobulbar neuritis was believed to have been caused by frontal sinusitis.

George A. Filmer.

Gözberk, R. **Optic neuritis of nasal origin.** Türk Oft. Gazetesi, 1939, v. 3, pt. 4, p. 214. (French abstract, p. 241.)

In two cases local treatment of nasal congestion was followed by subsidence of an optic neuritis.

George A. Filmer.

Leinfelder, P. J., and Stump, R. B. **Thiamine hydrochloride in the treatment of tryparsamide amblyopia.** Arch. of Ophth., 1941, v. 26, Oct., pp. 613-618.

Two cases are reported in which ocular reactions were observed after the administration of tryparsamide. The first patient had a clinical pellagra prior to the administration of tryparsamide and had been given therapeutic oral doses of thiamine hydrochloride and nicotinic acid for 11 days before the first injection of tryparsamide. This case illustrates that thiamine hydrochloride has no prophylactic effect, for while therapeutic doses of thiamine hydrochloride and nicotinic acid resulted in rapid improvement of the pellagra syndrome, they did not prevent an ocular tryparsamide reaction. Vitamin therapy was not utilized for the second patient until definite evidence of peripheral contraction of the visual fields had occurred. In spite of large intramuscular doses of thiamine hydrochloride, progressive contraction of the visual fields continued. This patient received one injection of tryparsamide after definite recognition of the field changes, because it was hoped that the use of thiamine hydrochloride might prevent further changes in the fields and allow continuation of the treatment. However, when the fields showed further constriction, the administration of tryparsamide was discontinued. The end result in these cases was good in that visual acuity remained normal in one patient and would perhaps have been normal in the other if clouding of the cornea had not followed an iridocyclitis in one eye. Judging by the visual fields, thiamine hydrochloride did not have any mitigating effect on the severity of the tryparsamide reactions. Neither thiamine hydrochloride nor nicotinic acid apparently has any significant effect on the occurrence or progress of visual-field changes following tryparsamide therapy. J. Hewitt Judd.

## 12

### VISUAL TRACTS AND CENTERS

Balado, M., and Oribe, M. F. **Encephalography in the diagnosis of chiasmal and pituitary lesions.** Arch. de Oft. de Buenos Aires, 1940, v. 15, Aug., p. 377.

The authors discuss the value of encephalography with air injection in order to determine with certainty the presence of a pituitary or peripituitary tumor. This diagnostic procedure is used only when there is no papilledema present. Air is injected by lumbar or occipital puncture, withdrawing an equal amount of spinal fluid. Frontal and lateral stereoscopic X-ray plates afford the best means of visualization of the lesions. The history, clinical findings, and results of surgical intervention in four cases of chiasmal and pituitary tumors are presented to demonstrate the diagnostic value of encephalography. (Photographs, visual-field charts, X rays, photomicrographs, bibliography.) Plinio Montalván.

Brain, W. R. **A form of visual disorientation resulting from lesion of the right cerebral hemisphere.** Proc. Royal Soc. Med., 1941, v. 34, Oct., pp. 771-776.

Three cases are reported of a form of visual disorientation resulting from le-

sions of the parieto-occipital region of the right cerebral hemisphere. This form of visual disorientation is an inattention to, or a temporary agnosia for, the left half of external space. In moderate degrees this is characterized by disorientation of walking. In more severe forms there is complete disorientation in space. This form of disorientation seems to occur only as a result of lesions of the right hemisphere. It differs from failure to appreciate visually the relative and absolute distances of objects. T. E. Sanders.

Lowenstein, O., and Bender, M. B. **Recovery of pupillary function in cut optic nerves of cats and monkeys.** Proc. Soc. Exper. Biol. and Med., 1941, v. 48, Nov., p. 447.

In a preliminary report the authors show that in the cat there is some restitution of function of afferent fibers to the pupillary centers after cutting the optic nerve. T. E. Sanders.

Maltby, G. L. **Visual-field changes and subdural hematoma.** Surg., Gyn., and Obstet., 1942, v. 74, Feb. 16, pp. 496.

While field changes have been considered of little value in the diagnosis of subdural hematomas, nevertheless, in reviewing a series of 62 cases, the author found that seven cases (11 percent) showed evidence of visual-field defect. In each case the field defect was homonymous in character, being contralateral to the clot in five instances and ipsolateral in one. In one case the defect was left-sided, the subdural clot being centrally placed. Four patients showed complete recovery. Maltby believes that the field changes were caused by herniation of the uncus or tentorium obstruction in the region of the posterior cerebral artery. The visual-field changes were twice as reliable as pupillary changes in attempting to localize the subdural clot. The author emphasizes the importance of early removal of the cause of the herniation.

Ralph W. Danielson.

Natale, A., and Dickman, G. H. **Incomplete bitemporal hemianopsia in a case of tumor of the posterior cranial fossa.** Arch. de Oft. de Buenos Aires, 1940, v. 15, July, p. 343.

The author reports a case of bilateral papilledema and incomplete bitemporal hemianopsia with enlargement of the blind spot. There was moderate visual loss, more marked in the right eye. The general physical and neurologic examinations were negative. The ventriculogram showed a bitemporal distention of the ventricular system with marked dilatation of the aqueduct of Sylvius. A diagnosis of tumor of the fourth ventricle or the inferior vermis was made. A suboccipital craniectomy revealed the presence of a hemangioma in the fourth ventricle which was removed in toto. Recovery was uneventful except for the presence of a slight postoperative paralytic strabismus and persistence of the visual-field defects.

The author describes in detail the campimetric signs which may be found in lesions of the posterior cranial fossa and believes that in the case reported the distention of the supraoptic recess is responsible for the bitemporal hemianopsia. In other instances, however, the visual-field defects may be due to pressure and displacement of the chiasm by vascular trunks. (Photographs, X-ray plates, photomicrographs, bibliography.)

Plinio Montalván.

Ruedemann, A. D. **Differential diagnosis of brain lesions.** Trans. Sec. on

Ophth., Amer. Med. Assoc., 1940, 71st mtg., p. 32.

In order to evaluate the relative merits of air localization and visual-field studies in diagnosis, Ruedemann studied a series of 150 unselected cases of verified brain lesions. He found positive results for encephalography in 103 out of a possible 128 cases. Field studies were suggestive in 84 (56 percent) cases. Field studies in conjunction with other eye signs gave positive diagnostic evidence more often than encephalography. Perimetry should be done early and often. No method of study is sufficient in itself and every diagnostic aid should be utilized. (Discussion.)

George H. Stine.

Walsh, F. B., and King, A. B. **Ocular signs of intracranial saccular aneurysms. Experimental work on collateral circulation through the ophthalmic artery.** Arch. of Ophth., 1942, v. 27, Jan., pp. 1-33.

This paper is divided into three parts. Part one illustrates the topical diagnosis from the standpoint of ocular signs and is illustrated by eight case reports; part two contains a description of ocular signs, hitherto undescribed as associated with saccular aneurysms (three case reports); and part three is based upon experimental work which demonstrates the richness of the anastomoses between the branches of the external carotid artery and those of the ophthalmic artery (two case reports). A brief review of the relevant anatomy and pathology is given. A summary of the findings in 32 cases is presented in a table and reviewed to exemplify the principles of topical diagnosis. Misdirection of regenerated fibers in the third nerve is revealed in some cases by anomalous movements of the upper eyelid, as when the lid is elevated during an attempt to move the eye with muscles innervated by the third nerve. Misdirection of regenerated fibers also accounts for a type of unilateral Argyll Robertson pupil. Phenomena dependent on denervation may be observed as a result of aneurysm. Those described here are an occasional elevation of the lid in the presence of an apparently complete oculomotor-nerve paralysis, and contraction of the pupil in the same eye when mecholyl chloride is instilled into the conjunctival sac.

J. Hewitt Judd.

## 13

### EYEBALL AND ORBIT

Aird, R. B. **Experimental exophthalmos and associated myopathy induced by the thyrotropic hormone.** Annals Internal. Med., 1941, v. 15, Sept., p. 564. (See Amer. Jour. Ophth., 1941, v. 24, p. 476.)

The fact that exophthalmos may occur with hyperthyroidism and yet may steadily progress to a malignant form in the presence of postoperative hypothyroidism suggests an indirect relationship with hormones affecting the thyroid gland, such as the thyrotropic hormone of the anterior pituitary body. Experimental exophthalmos was produced by the use of various extracts of the anterior pituitary body. After several months of injection, the exophthalmos was found to persist although the injections were discontinued. Myopathy of the extraocular muscles observed in the experimental animals was qualitatively consistent with the changes found in the extraocular muscles of human patients afflicted with malignant exophthalmos.

Edna M. Reynolds.

Batmaz, Azmi. **Two cases of hydatid cyst of the orbit.** Türk Oft. Gazetesi, 1939, v. 3, pt. 2, p. 69. (French abstract, p. 121.)

The patients were boys, aged 7 and 16 years respectively, and in each case the cyst was removed surgically. The Weinberg reaction was positive in both cases, and one showed an eosinophilia.

George A. Filmer.

Berliner, M. L. **Unilateral microphthalmia with congenital anterior synechiae and syndactyly.** Arch. of Ophth., 1941, v. 26, Oct., pp. 653-660.

Two first cousins, girls aged 5½ and 1½ years respectively, presented unilateral microphthalmia, associated with anterior synechia which extended from the lesser arterial circle of the iris to the posterior corneal surface. The corneal site of attachment of the iritic membranes was marked by the presence of a hyaline membrane. Both presented partial syndactyly of fingers and toes. These defects, considered hereditary, are explained on the basis of an unknown defect irregularly dominant in the germ plasm. It is suggested that the aberrations in Ciotola's cases (microphthalmia, coloboma, syndactyly and polydactyly) and in the two reported here should be placed in a special category. The article is illustrated with drawings and photographs.

J. Hewitt Judd.

Fischer, F. P. **Senile changes in the eyes.** Ophthalmologica, 1941, v. 102, Oct., p. 226.

Fischer has accumulated data on three hundred subjects in each of the first seven decades of life. For the eighth decade only one hundred were available. For each subject he recorded the presence or absence of: gerontoxon, depigmentation of the iris stroma, pigment deposits on the posterior corneal surface, depigmentation of the pupillary margin, depigmentation of the posterior pigment-cell layer of the iris, and opacities in the lens. In each case he constructed a graph in which he used the percentage frequency of occurrence as the ordinate and the age class as the abscissa. For all the phenomena he obtained "s" curves, or if plotted logarithmically, a straight line. All curves have all the characteristics of a saturation curve, and show that the frequency increases with age.

F. Herbert Haessler.

Freyler, Heinrich. **Anatomic changes in subconjunctival and intraocular tissues produced by subconjunctival tuberculin injections.** Graefe's Arch., 1940, v. 142, pt. 4, pp. 437-447.

Three cases are reported in which subconjunctival injections of tuberculin were given prior to enucleation for intraocular sarcoma. In the first case an unknown quantity and in the second case 0.1 mg. of tebeprotein was given nine days before enucleation. In the third case 0.001 mg. of tebeprotein was injected nine days before enucleation, followed by a second injection of 0.01 mg. two days later. In the first two cases the subconjunctival injection was followed by a marked conjunctival chemosis. The third case showed no reaction until after the second injection, when there was a marked conjunctival chemosis with many small hemorrhages in the region of the injection and a few small gray flecks in the corneal periphery. On pathologic examination case one and case two were each found to have a massive melanosarcoma occupying the upper half of the eye. In the first case nodules of epithelioid and round cells and a few giant cells were found in the neighborhood of the in-

jection and over the tumor in the subconjunctival and episcleral tissues. Since most of the uveal tract was replaced by tumor no reaction to the injection was noted. The second case showed a nonspecific perivascular round-cell infiltration in the episclera near the site of injection but not near the tumor. This infiltration was thought to be due to the injection. There was also a round-cell and eosinophilic infiltration of the lower choroid near the confluence of the vortex veins, which the author believed was the result of the inflammatory effect of necrotic areas in the tumor. The third case had a large nonpigmented spindle-cell sarcoma showing no areas of necrosis. The anterior section of the eye including the iris was normal except for some albumin in the aqueous. Therefore the author assumes that there was no inflammatory reaction from the tumor. From the region of the injection there was a spread of epithelioid and round-cell infiltration in the episclera. In the region of the anterior emissary veins this infiltration penetrated the sclera. Round cells were seen in Schlemm's canal and in the pars plana of the ciliary body. In the choroid tubercular nodules were found. The author suggests that this may have been an early stage of chronic tuberculous choroiditis.

Frances C. Cogan.

Friedgood, H. B. **Clinical applications of studies in experimentally induced exophthalmos of anterior pituitary origin.** Jour. Clin. Endocrinology, 1941, v. 1, Oct., p. 804.

The author considers in much detail (1) the anatomy of the orbit in man and other mammals, (2) the effect of cervical-sympathetic stimulation upon the position of the eyeball, (3) the production of exophthalmos with anterior-pituitary extracts, (4) the pathologic physiology of exophthalmos, and (5) the clinical differentiation of special eye cases from the ordinary syndrome of exophthalmic goiter.

The observations presented indicate that exophthalmic goiter is a syndrome in which either the thyroid or the eyes may present the outstanding problem in therapy. It is highly desirable, therefore, to attempt to differentiate clinically between these two types. In the one thyroidectomy is at present usually the treatment of choice, while in the other this operation may precipitate a disastrous ocular complication. Clinical experience must be supplemented by experimental laboratory data. Since edema of the orbital tissues is probably an early pathologic change in the latter type of case, one should regard with suspicion any preoperative chemosis, lacrimation, or puffiness and venous congestion of the eyelids. The development of hypothyroidism during iodine therapy or the presence of thyrotropic hormone in the urine should likewise put one on guard, since these findings are associated with an abnormal decrease in thyroid function, which is undoubtedly a predisposing factor in the development of ocular complications. These features should likewise be warning signals in the postoperative period. The medical treatment of postoperative malignant exophthalmos, once it has developed, is notoriously unsatisfactory. Desiccated thyroid, either alone or in combination with iodine, has given only meager success.

It is concluded that the exophthalmos in Graves's syndrome, like that of the guinea pig injected with an extract of the anterior pituitary gland, goes through two phases, the reversible and the irreversible. The former is ordinari-

ly encountered in exophthalmic goiter; the latter infrequently occurs as a post-thyroidectomy complication, or rarely precedes the development of hyperthyroidism. The evidence also suggests that an exophthalmos-producing (ophthalmotropic) factor in the pituitary gland, distinct from the thyrotropic hormone, induces both types of exophthalmos. (51 references.)

Ralph W. Danielson.

Gözcü, N., and Tarkan, K. **Varicocele of the orbit.** Türk Oft. Gazetesi, 1939, v. 3, pt. 3, p. 123. (French abstract, p. 197.)

A 22-year-old soldier complained of intermittent exophthalmos and discoloration of the eyelids. Bending the head forward caused protrusion of the eye and engorgement of the retinal veins. Treatment of the case is not mentioned. George A. Filmer.

Hertz, S., Means, J. H., and Williams, R. H. **Graves's disease with dissociation of thyrotoxicosis and ophthalmopathy.** Western Jour. Surg., Obstet., and Gyn., 1941, v. 49, Sept., p. 493.

According to the authors, there is abundant evidence that eye involvement is not the direct result of thyrotoxicosis. The toxic and ocular types have been observed independently. Experimentally, exophthalmos has been produced in thyroidectomized animals by administration of extracts of the anterior lobe of the pituitary. However, the thyrotoxic and ophthalmic manifestations usually run parallel, the control of the former being the major therapeutic problem. In about four percent of the cases of Graves's disease, ophthalmopathy and thyrotoxicosis vary independently or inversely, and in these the former is the major problem.

The eye signs prevailing in the special ophthalmic type tend to differ from those in the classic type. In the latter the most conspicuous features are exophthalmos, lid lag, lid retraction, and other signs of the sort described in the earlier literature. In the special eye type the accent is on edema and irritative phenomena, and ophthalmoplegia is common, with resulting visual symptoms such as diplopia.

The pathogenesis of the ophthalmopathy in either type is obscure. The weight of evidence is against its being the direct result of sympathetic overactivity. A possible factor is disturbance of balance between the anterior pituitary and its thyrotropic, or thyroid-stimulating hormone, which in addition to its better-known actions has of late been shown to exert an inhibiting effect upon the pituitary.

The authors believe that in the special eye type the therapeutic attack should be aimed at relieving orbital swelling rather than thyrotoxicosis. The agent most definitely indicated is thyroid hormone and the measure most definitely contraindicated is thyroidectomy. The authors' usual treatment is to hold the basal metabolic rate as low as it will go under administration of iodine and to add to this as large a ration of thyroid as can be given without producing hyperthyroidism. The metabolic actions of the two agents are opposite, but it is the diuretic action of the thyroid that is sought, and this is not opposed by iodine. (25 references.)

Ralph W. Danielson.

Hughes, W. L. **Socket reconstruction.** Arch. of Ophth., 1941, v. 26, Dec., pp. 965-968.

The newer developments outlined by the author consist in the use of a concavo-convex form around which the Thiersch graft from the leg is wrapped

and fixed with rubber cement. The form (in which there are two holes to facilitate handling) is flexible to enable an insertion to be made without undue enlargement of the interpalpebral fissure, but is of sufficient thickness to retain its shape after insertion. A mattress suture is applied to the under surface of the lids near their margins to draw them together over the wrapped form. A pressure bandage is applied and left in place for from five days to a week. The dressing is changed every four or five days for three weeks. The form is not removed for two weeks, at which time it has been released by desquamation and necrosis of the superficial layers of the skin and can be readily lifted out by a Lester forceps passed into the holes to elevate the lower margin. The socket is ready for a prothesis at the end of three or four weeks. The procedure is well shown in photographs. J. Hewitt Judd.

Lagos, E. J. J., Tiscornia, J., and Riva, A. **Infectious processes of the orbit.** Arch. de Oft de Buenos Aires, 1940, v. 15, May, p. 213; and June, p. 265.

This official communication to the Argentine Society of Ophthalmology contains a review of the subject under various headings.

Lindeman, Heinz-Olaf. **Interesting findings in progressive hemiatrophy of the face.** Graefe's Arch., 1940, v. 142, pt. 4, pp. 409-427.

Two cases are reported. The first is that of a 26-year-old man who had been injured in the back of the neck at 11 years. The family history was negative. Physical examination showed atrophy of the left half of the face including the upper and lower lids and the eyeball, the latter being one half normal size. Ocular examination showed a diminished secretion of tears, and limitation of movement in all directions. The cornea was small (10 mm. horizontally, 9 mm. vertically). There was an exposure keratitis nasally with a deposit of calcium in the superficial epithelial and parenchymal layers. Temporally there was a small epithelial defect near the limbus. There were old pigmented precipitates on the posterior corneal surface. Corneal sensitivity was markedly decreased. The anterior chamber was irregularly deep. The iris was grayish brown, as compared with the greenish brown of the other eye, with an atrophic stroma depigmented at the pupillary margin. The pupil was irregular and narrow, and reacted weakly and incompletely to convergence and to light from the temporal side. There was a cataracta complicata. Vision was limited to light perception from the temporal side with projection defect. Dental examination revealed a disturbance in the growth of the roots of several teeth, which must have occurred at the time of the injury in childhood. This suggests the injury as the cause of the disease. A general physical examination revealed no other abnormalties. The second case showed a less-severe left-sided facial atrophy in a woman of 26 years. Atrophy of the lids produced the appearance of exophthalmos. The lower tear duct was not present. The amount of tears was normal. The ocular examination revealed no other abnormalities.

The author summarizes as follows: (1) Progressive hemiatrophy of the face must be a disturbance of the trophic function of the trigeminal and in some cases of the sympathetic as well. In rare cases the facial nerve is also involved. (2) Ocular involvement is not rare. (3) The genesis, disease pic-

ture, course, and complications parallel those of hemihypertrophy. (4) Examination of the eye, ear, larynx, and jaw is important. Frances C. Cogan.

Purtscher, E. **Fetal hydrophthalmos with malformation of the orbit due to amniotic bands.** Graefe's Arch., 1940, v. 142, pt. 4, pp. 453-458. (See Section 8, Glaucoma and ocular tension.)

## 14

## EYELIDS AND LACRIMAL APPARATUS

Elvera, Mehmed. **A case of xeroderma pigmentosum with angioma of the lids.** Türk Oft. Gazetesi, 1939, v. 3, pt. 3, p. 153. (French abstract, p. 199.)

The condition is incurable and is thought to be related to consanguinity in the parents. The case occurred in an 11-year-old boy. There were ectropion of the lower lids, ulceration and leucoma adherens of the cornea, symblepharon, and pigmented plaques on the bulbar conjunctiva.

George A. Filmer.

Friedman, Benjamin, **A combination dilator and irrigation needle for the lacrimal canal.** Arch. of Ophth., 1941, v. 26, Dec., pp. 1062-1063.

In order to prevent the punctum from contracting before the irrigating syringe can be inserted after the dilator is removed, a combination dilator and irrigation needle was devised, to fit a standard 2-c.c. syringe. The opening is about 0.25 mm. wide, and the tip is about 0.4 mm. over all. A stylet may be inserted to facilitate entering very small puncta. J. Hewitt Judd.

Garfin, S. W. **Etiology of dacryocystitis and epiphora.** Arch. of Ophth., 1942, v. 27, Jan., pp. 167-188.

From the findings reported in the literature the author concludes that dacryocystitis is contingent on stenosis of the nasolacrimal duct, either congenital or acquired, plus a secondary infection. The opinion of the majority of the authors cited is that the etiologic factor is usually an acute or chronic inflammation of the nose or disease of the sinuses. Physical or surgical trauma and infectious diseases of the nose may also play a part in the causation of dacryocystitis. Specific chronic inflammatory diseases, such as tuberculosis and syphilis, not infrequently cause dacryocystitis. Benign or malignant neoplasms occasionally involve the lacrimal-drainage apparatus either by primary involvement or by metastases. The disease less frequently arises from the eye. Epiphora may result from reflex irritation or from stimulation of the facial or the vagus nerve or of sympathetic nerves. In a number of cases the cause of the dacryocystitis cannot be ascertained.

J. Hewitt Judd.

Gill, J. P. **A suction device for use in the treatment of styes.** Arch. of Ophth., 1941, v. 26, Oct., p. 676.

This consists of the suction outfit usually sold for the treatment of snakebite, the glass tip of a medicine dropper being substituted for the larger metal tip when a smaller tip is desired. The point of the dropper is fitted into the rubber bulb and the flanged end applied to the area of suppuration after incision.

J. Hewitt Judd.

Gözcü, N. **Palpebral elephantiasis.** Türk Oft. Gazetesi, 1939, v. 3, pt. 4, p. 210. (French abstract, p. 241.)

The condition was caused by lymphofibromatosis and was bilateral.

George A. Filmer.

Gözcü, N. **Palpebral manifestation of proliferating tuberculosis.** Türk Oft. Gazetesi, 1940, v. 3, pt. 5, p. 250. (French abstract, p. 294.)

A tumor of the upper lid causing some ptosis was removed and found to be tuberculous. George A. Filmer.

Rumbaur, W. **Treatment of suppurative dacryocystitis.** Graefe's Arch., 1940, v. 142, pt. 4, pp. 477-481.

The author describes a double-edged knife with which strictures of the lacrimal duct may be divided on two sides. He prefers this knife to Weber's single-edged knife, as cutting the stricture on two sides prevents a secondary closure from the normal pull of the surrounding elastic tissue. The author recommends his operation in long-standing chronic dacryocystitis where probing has failed. Of two hundred cases of chronic suppurative dacryocystitis treated by the author's method, ninety were seen again; of these latter 90 per cent had been completely cured by the operation, and probably a large number of the others. The author concludes that many serious operations on the tear duct could be avoided by employing his treatment.

Frances C. Cogan.

Sandra, Muzaffer. **Plastic correction of palpebral ectropion.** Türk Oft. Gazetesi, 1940, v. 3, pt. 5, p. 260. (French abstract, p. 295.)

The author uses a dermo-epidermal graft, a modification of the Thiersch and Wolfe techniques.

George A. Filmer.

Scobee, R. G. **The role of the meibomian glands in recurrent conjunctivitis.** Amer. Jour. Ophth., 1942, v. 25, Feb., pp. 184-192. (3 figures, 1 table, references.)

## 15

## TUMORS

Çambel, P. **Papillomas of the cornea.** Türk Oft. Gazetesi, 1939, v. 3, pt. 2, p. 80. (French abstract, p. 120.)

The author discusses and differentiates epithelial plaques, papillomas, and epitheliomas of the cornea. In the case reported the papilloma covered the entire cornea and was attached to the limbus. There was no ulceration.

George A. Filmer.

François, Jules. **Rhabdomyosarcoma of the orbit.** Ophthalmologica, 1941, v. 102, Sept., p. 129.

To the 13 cases of rhabdomyosarcoma described in the literature, the author adds another. His 61-year-old patient first noted diplopia which had resulted from abducens paralysis. In a month the entire picture of orbital tumor had developed. Tissue obtained by exenteration of the orbit was found on microscopic study to be typical rhabdomyosarcoma. The patient died four weeks later from lung metastases.

F. Herbert Haessler.

Guha, G. S. **A case of blepharochalasis.** Indian Jour. Ophth., 1941, v. 2, Jan., p. 6.

A lipoma between the orbicularis and the tarsus of the upper lid in a girl of 17 years had so increased in size over a period of three or four years as to render it difficult for the patient to open her eyes. The tumor was removed surgically, and the Hotz entropion operation was performed with satisfactory results.

Edna M. Reynolds.

Igersheimer. **Differential diagnosis of diseases of the inner angle of the orbit.** Türk Oft. Gazetesi, 1939, v. 3, pt. 1, p. 1. (French abstract, p. 58.)

A 32-year-old woman with exophthalmos was found to have a tumor the size of a small pigeon's egg in the upper inner angle of the orbit. The tumor was removed by the Krönlein procedure, and was found to be a cavernous angioma. Another tumor in a similar location was found to be a dermoid cyst. George A. Filmer.

Lehrfeld, Louis. **Is enucleation indicated in early cases of intraocular malignant melanoma?** Amer. Jour. Ophth., 1942, v. 25, Feb., pp. 199-202.

McGavic, J. S. **Intraepithelial epithelioma of the cornea and conjunctiva (Bowen's disease).** Amer. Jour. Ophth., 1942, v. 25, Feb., pp. 167-176. (6 figures, bibliography.)

Martin, Hayes, and Reese, A.B. **Treatment of retinoblastoma (retinal glioma) surgically and by irradiation.** Arch. of Ophth., 1942, v. 27, Jan., pp. 40-72; also Trans. Amer. Acad. Ophth. and Otolaryng., 1941, 45th mtg., March-April, p. 70.

A detailed report is made on 23 patients with retinoblastoma who were referred to the Memorial Hospital for the Treatment of Cancer and Allied Diseases during the years 1930 to 1940 inclusive. The report includes a follow-up to date on the six cases of bilateral tumors previously reported (Amer. Jour. Ophth., 1937, v. 20, p. 553), in which one eye was enucleated and the other given fractionated irradiation, and submits preliminary data on four more recent cases with bilateral retinoblastoma in which the treatment was similar. It is pointed out that this series does not represent retinoblastoma in general since the majority of the patients were referred because of advanced or bilateral tumors. The selection of the method of treatment is discussed and the techniques of various types of treatment are described. For bilateral retinoblastoma it is urged that the more involved eye be enucleated and radiation therapy be given to the other in an attempt to control the disease and conserve vision. The technique of the radiation therapy, which has been modified slightly from the original description, is described in detail. A series of ten patients with bilateral retinoblastoma includes eight in whom treatment was successful, the vision being satisfactory in five after 7 years, 6 years, 2¼ years, 2 years, and 3 months respectively. Pathologic observations are reported in detail only for eyes enucleated after receiving radiation. The results in this series indicate that if it is known immediately after enucleation that the tumor has been left in the optic nerve, the patient has over a 66-percent chance of recovering with immediate radiation, but if such residual tumor is not known to be present and is attacked only when it reappears, there is only about a 10-percent chance of recovery. J. Hewitt Judd.

Samuels, Bernard. **Tumors of conjunctiva and lids.** Arch. of Ophth., 1941, v. 26, Nov., pp. 789-796.

As benign tumors of the conjunctiva the author briefly reviews simple granuloma, polyp, papilloma, angioma, cyst, lipoma, dermoid tumor, and nevus. The malignant tumors of the conjunctiva discussed are epibulbar sarcoma, precancerous melanosis, diffuse malignant melanoma, and epibulbar carcinoma. Tumors of the lids discussed are sarcoma and carcinoma. It is pointed out that a definite relationship exists between malignant tumors of the lids and intraocular melanomas of the uvea. It

is necessary to handle the tissues gently when taking biopsy specimens, and they should be taken only when it is imperative to confirm a diagnosis, as malignant cells may easily be disseminated into the field adjoining the tumor. When a carcinoma of the lid is relatively small and superficial, the best treatment is with roentgen rays and radium, as this causes destruction of the capillaries in the adjacent tissue and sterilizes the tissues in a wide area around the visible, palpable tumor.

J. Hewitt Judd.

Weskamp, C., and Cotlier, I. **Cerebral and retinal angiomata with capillary malformations of the skin.** Arch. de Oft. de Buenos Aires, 1940, v. 15, Jan., p. 1.

The authors point out the importance of the nosologic entity described by Lindau and emphasize the value of ophthalmoscopic diagnosis in retinal angioma. Angioma of the nervous system is of two types. The first type involves the cerebellum, the bulb, and the medulla, with concomitant lesions of various organs, including the retina. The histopathologic structure shows capillary angiomata composed of reticulo-endothelial cells. The second type involves the cerebrum and other parts of the nervous system (except the cerebellum, bulb, and medulla), with concomitant lesions of the skin. The structure corresponds to the cavernous angioma. This latter type of cerebral angiomata, of varying symptomology that has been grouped under the name of neurocutaneous syndrome, is characterized by paralysis, mental derangement, and ocular manifestations, such as congenital glaucoma, exophthalmos, and nystagmus (most frequently unilateral).

From the ocular standpoint the authors stress the frequency of Lindau's syndrome, in which the angiomatous process involves the bulb, medulla, internal organs, and retina, the last manifestation being designated by ophthalmologists as Hippel's disease. On the other hand, the coexistence of cavernous angioma of the brain and skin with angioma of the retina has not been proved histologically.

The authors report the case of a 17-year-old girl with cavernous angioma, verified histologically, and a retinal angioma, which in ophthalmoscopic characteristics was entirely different from the angioreticulomas of Hippel's disease. (Photomicrographs, bibliography.) Plinio Montalván.

## 16

### INJURIES

Ayberk, N. F. **A case of luxation of the lens into the anterior chamber, tolerated for 25 years.** Türk Oft. Gazetesi, 1939, v. 3, pt. 1, p. 21. (French abstract, p. 62.)

The lens had been displaced into the anterior chamber during a trauma 25 years previously. Occasional rises in intraocular pressure were the only untoward incidents. George A. Filmer.

Brown, A. L. **Lime burns of the eye.** Arch. of Ophth., 1941, v. 26, Nov., pp. 754-769; also Trans. Sec. on Ophth., Amer. Med. Assoc., 1941, 92nd mtg.

Experiments on rabbits suggest that chemical alteration of the palpebral conjunctiva in contact with the cornea is harmful. This probably explains why conservative treatment of severe lime burns with ointment or drops is worthless in preventing delayed corneal erosion and symblepharon. The delayed severe corneal erosions after lime burns are usually due to the caustic effects of burned palpebral conjunctiva in con-

tact with the cornea. The experiments used the thinnest portions of rabbit peritoneum as implants, in order to separate the affected surfaces completely with a smooth tissue. The technique is described and shown in drawings. The flap is removed when the cornea is healed and the palpebral conjunctiva seems quiet. It is usually best to leave the flap for three weeks or longer if no reaction or infection is manifest. The flap may be replaced whenever it becomes macerated or begins to shred. The use of this substance is apparently efficacious after most corrosive chemical burns. Four cases are reported illustrating the use of this technique. (Discussion.) J. Hewitt Judd.

Brückner, R. **Scarring and shrinking of the conjunctiva as an industrial injury in dyers.** Ophthalmologica, 1941, v. 102, Oct., p. 221.

In two elderly dyers the author observed bilateral shrinkage of the conjunctiva with scarring, which he ascribed to the effect of exposure to chemical vapors. Individual peculiarities of metabolism and involutional changes may have played a part. The possibility of direct injury was denied by the patients.

F. Herbert Haessler.

Curdy, R. J. **The influence of gravity on intraocular foreign bodies.** Amer. Jour. Ophth., 1942, v. 25, Feb., pp. 208-209.

Doherty, W. B. **Some of the most important ocular and orbital wounds in war.** Amer. Jour. Ophth., 1942, v. 25, Feb., pp. 135-149. (13 figures, one color plate.)

Goar, E. L. **Retinal hemorrhages following the ingestion of sulfathiazole.** Amer. Jour. Ophth., 1942, v. 25, March, pp. 332-333. (2 case reports.)

Gorduren, Sureya. **Detachment of the retina and accidents in general.** Turk Oft. Gazetesi, 1940, v. 3, pt. 5, p. 255. (French abstract, p. 295.) (See Section 10, Retina and vitreous.)

Grolman, G. **Mucous-membrane graft in the treatment of corneo-conjunctival burns.** Arch. de Oft. de Buenos Aires 1940, v. 15, Aug., p. 429.

Mucous-membrane graft is the method of choice, and at times the only one possible in the treatment of extensive burns of the conjunctiva. The operation must be done early enough to prevent destruction of the sclera, in which case the delayed vascularization of the graft produces necrosis of the cornea. Further study of grafting material would be desirable, especially in regard to the possibility of using fetal membranes or conjunctiva from cadavers, which may give a better cosmetic result than that obtained with mucous membrane from the mouth.

Plinio Montalván.

Lisch, Karl. **The presence of calcium crystals in the cornea after erosion with calcium.** Graefe's Arch., 1940, v. 142, pt. 4, pp. 503-505.

A 27-year-old mason scratched his right cornea with lime, and after four years suffered loss of vision. It was found upon examination that he could just distinguish fingers. The cornea showed many fine opacities in the superficial subepithelial layers and there was a grayish-white opacity in the deepest parenchymal layers of the corneal center. With the slitlamp many chalk-white granules and star-shaped crystals could be seen in the superficial and middle corneal layers. The

other eye was normal. The author thinks that the crystals and granules were probably calcium phosphate and calcium carbonate. Since very few persons with corneal injuries from calcium develop such opacities the author concludes that there must have been a disturbance of calcium resorption in this patient, the slight increase of calcium introduced into the cornea at the time of injury causing precipitation of the crystals. Frances C. Cogan.

McAlpine, P. T., and Berens, C. **Allergic dermatitis and blepharoconjunctivitis caused by pontocaine.** Amer. Jour. Ophth., 1942, v. 25, Feb., pp. 206-207. (References.)

Muhlmann, V., and Ré, B. V. **Traumatic retinal angiopathy.** Arch. de Oft. de Buenos Aires, 1940, v. 15, Jan., p. 11.

In a case of traumatic retinal angiopathy (Purtscher's disease) in a 30-year-old man, the authors were able to make photographic records of the fundus lesions during the 15 months following the accident. The patient sustained a gunshot wound in the right cervical region, producing a traumatic arteriovenous communication between the carotid and internal jugular. The ophthalmoscopic examination 48 hours after the accident was negative. Three days later there was a reduction of visual acuity and the right fundus showed numerous small white patches situated on the posterior pole and near the central retinal vein and its branches. Daily ophthalmoscopic examination revealed very slow absorption of these exudates, which were never accompanied by retinal hemorrhages. The fundus picture gradually cleared and at the last examination, 15 months after the accident, the fundus was entirely normal, but there was no marked improvement in visual acuity. The authors present a very detailed account of 37 cases of Purtscher's disease collected from the literature, both Argentine and foreign, and an exhaustive exposition of the symptomatology and pathogenesis of the condition, stressing its medico-legal aspect. Plinio Montalván.

Thomas, Maxwell. **Knife injury.** Amer. Jour. Ophth., 1942, v. 25, Feb., p. 210.

## 17

### SYSTEMIC DISEASES AND PARASITES

Assinder, E. W. **Syphilis in ophthalmology.** Brit. Jour. Ophth., 1942, v. 26, Jan., pp. 1-23.

A survey of 6,839 cases of suspected syphilis seen by the author over a 15-year period is given; 1,015 cases gave positive Wassermann results. The majority of cases of syphilis of the eye were of keratitis (553 cases in this series); 43 percent were limited to one eye, which the author attributes to the fact that all forms of heat applications to the affected eye were religiously avoided.

Nerve lesions occurred in 119 cases; of these 74 were primary optic atrophies. According to the author, the atrophy of the disc is not primary, but the result of atrophy of the nerve cells in the retina due to an arteritis. Argyll Robertson pupils are occasionally due to a meningitis not caused by syphilis. One case due to chorea is reported.

A course of treatment for primary and secondary syphilis is outlined and it is emphasized that in early syphilis intervals of more than a month without arsenic and bismuth should be avoided. Three years is regarded as the minimum duration for treatment and some sort of specific treatment for life is

advised for the patient who retains a positive Wassermann reaction in blood and spinal fluid.

Edna M. Reynolds.

Berens, Conrad, and Nilson, E. L. **Ocular conditions associated with coliform bacteria.** Arch. of Ophth., 1941, v. 26, Nov., pp. 816-839; also Trans. Sec. on Ophth., Amer. Med. Assoc., 1941, 92nd mtg.

Bacteriologic studies of material from one or more suspected foci in the upper respiratory tract were made for 411 patients. Of these, 102 patients harbored coliform bacteria in one or more of the foci and 68 percent of this latter group had some intraocular disease. Autogenous coliform-bacteria vaccines were used in treating certain patients who had ocular inflammations associated with the presence of these organisms in the upper respiratory tract. In many instances in which vaccine therapy was associated with partial or complete elimination of coliform bacteria from the upper respiratory tract, there was a noticeable improvement in the general and the ocular condition. Four cases are reported in detail. Nine cases are outlined to show the changes in the bacterial flora of the upper respiratory tract in patients undergoing vaccine therapy. The authors found that serious ocular disease was often associated with the presence of coliform bacteria in the upper respiratory tract and that elimination of these microbes from the upper respiratory tract, in which vaccine therapy seemed to be a factor, was associated with improvement and sometimes with cure of certain inflammatory ocular diseases. Coliform bacteria from the upper respiratory tract should be given consideration in the search for possible etiologic agents in some chronic and inflammatory ocular diseases. (Discussion.)

J. Hewitt Judd.

Igersheimer. **Dental disease and ocular disorders.** Türk Oft. Gazetesi, 1939, v. 3, pt. 4, p. 203. (French abstract, p. 239.)

A general discussion of the relationship of dental infection to various eye diseases. George A. Filmer.

McFarland, R. A., Evans, J. N., and Halperin, M. H. **Ophthalmic aspects of acute oxygen deficiency.** Arch. of Ophth., 1941, v. 26, Nov., pp. 886-913.

An analysis of the effects of oxygen deficiency on visual function is presented, chiefly from the viewpoint of ophthalmology, with a brief review of the physiologic effects of oxygen deprivation and the psychologic changes associated with anoxia. As to light sense, it is found that the light minimum and dark adaptation are impaired, but the studies relating to light difference are inadequate. Visual acuity is found to be decreased in dim light but practically unaffected in bright light. Studies of the effect of anoxia on peripheral visual fields and color zones are inadequate thus far. Central visual fields are decreased by widening of the angioscotoma. Color vision is apparently further impaired if abnormal prior to anoxia. The latent period of the after-image is prolonged. The diameters of the retinal arteries and veins are increased about one eighth. Weakness of the extraocular muscles become significantly exaggerated, and the range of accommodation is decreased. The oculomotor reactions, such as those employed in reading, are less orderly, and latent defects become apparent. There is a diminished precision in ocular fixa-

tion, and motor anomalies become accentuated. (Bibliography.)

J. Hewitt Judd.

Ubaldo, A. R., and Ocampo, G. de. **The concept of focal infection in ophthalmology.** Jour. Philippine Med. Assoc., 1941, v. 21, Sept., p. 443.

Seven cases, including neuroretinitis, iridocyclitis, uveitis, and extraocular-muscle paralysis, are reported. The majority of the cases were acute, some of the recurrent type. A single determinable focus was present in most of the cases, in others multiple foci were found. While the authors obtained favorable results in their cases and believe in the concept of focal infection, they still take a cautious attitude. They are opposed to indiscriminate removal of any focus of infection, suggesting individualization of cases and a thorough consideration of multiplicity of factors. F. M. Crage.

Woods, A. C., and Burky, E. L. **Effect of sensitivity and immunity in experimental lesions of ocular tuberculosis.** Trans. Sec. on Ophth., Amer. Med. Assoc., 1940, 91st mtg., pp. 38-50. (See Amer. Jour. Ophth., 1941, v. 24, July, p. 845.)

## 18

### HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Blake, E. M. **State aid to blind in Connecticut.** Connecticut State Med. Jour., 1941, v. 5, Feb., p. 10.

This is a short article which starts with a brief history of the progress of financial help to the blind in the state of Connecticut. A table in life decades totalling 276 cases shows the greatest number of applications to be between forty and sixty years of age. Sex, results of blood tests for syphilis, eligibility for aid, and diagnoses are briefly reported and discussed. Listings are made under the particular structure of the eye affected.

In the diagnostic percentages, the most striking feature is the high number of sympathetic ophthalmia cases (15 or 5.4 percent). F. M. Crage.

Britten, R. H. **Blindness, as recorded in the National Health Survey—amount, causes, and relation to certain social factors.** Public Health Reports, 1941, v. 56, Nov. 14, pp. 2191-2215.

This very extensive report is based upon a survey of 2,500,000 persons. A few highlights may be mentioned: (1) The number of persons per 100,000 recorded as being blind in both eyes was 83, and the number blind in one eye only, 326. (2) Two thirds of those blind in both eyes were over 55 years of age. (3) The estimated annual incidence of new cases of blindness was 6.6 per 100,000 population. (4) For blindness in both eyes, falls, motor vehicles, burns, firearms, and fireworks were the principal means of injury; for blindness in one eye only, injuries from cutting and piercing instruments were by far the most frequent. (5) the prevalence of blindness due to accident was about five times as great among males as among females. (6) Blindness was twice as prevalent in the colored as in the white race. (7) The prevalence of blindness was greater in cities under 100,000 population than in large cities. (8) Two thirds of the blind were in families whose annual incomes were under one thousand dollars. (9) The rate in the group with incomes under one thousand dollars was about four times as great as that in families with incomes of five thousand dollars or more. Ralph W. Danielson.

Cowan, Alfred, and English, B. C. **Causes of blindness in Pennsylvania.** Arch. of Ophth., 1941, v. 26, Nov., pp. 797-807; also Trans. Sec. on Ophth., Amer. Med. Assoc., 1941, 92nd mtg.

The findings in 31,352 eyes of 15,676 persons 21 years of age or over whose visual acuity was 20/200 or less have become available since the enactment of pension laws in Pennsylvania for blind persons in 1934, and are here analyzed and tabulated as to causes of blindness. It is interesting to note that since a system of follow-up was inaugurated in 1939, the attempt to secure treatment has been made for 1,792 persons. Of this group 11.1 percent have had vision restored or improved, a further result being a substantial saving in the payment of pensions. (Discussion.)

J. Hewitt Judd.

Danielson, R. W., and Long, J. C. **Disability lawsuit following successful bilateral cataract extraction.** Amer. Jour. Ophth., 1942, v. 25, Feb., pp. 164-167.

Davis, W. T., and Meisenbach, A. E., Jr. **Ophthalmologic findings on draftees from the Washington, D.C., military area.** Amer. Jour. Ophth., 1942, v. 25, Feb., pp. 181-183. (2 tables.)

Leydhecker, F. K. **Note on the question of pictures of Graefe.** Graefe's Arch., 1940, v. 142, pt. 4, pp. 389-391.

A hitherto unknown photograph of Graefe is reproduced. It is evidently the original of at least nine photographs and paintings. Frances C. Cogan.

Lijo Pavia, J., Tartari, R. A., and Peña Guzman, C. **Credé method obligatory in municipal maternity hospitals.** Arch. de Oft. de Buenos Aires, 1940, v. 15, July, p. 335.

Discussion of the Credé method for the prophylaxis of gonococcic ophthalmia, made compulsory by law in the municipal maternity hospitals of Buenos Aires. Plinio Montalván.

Palmer, E. C. **Dark-adaptation characteristics of private-school children measured with the adaptometer.** Amer. Jour. Public Health, 1941, v. 31, Oct., p. 1063.

A report from the United States Public Health service describing the dark adaptation of 175 apparently healthy high-school children. The author states that thresholds for boys do not differ significantly from those for girls. Evidence is not conclusive that elevation of visual threshold results only from vitamin-A therapy.

Theodore M. Shapira.

Riddell, W. J. B. **The postgraduate study of ophthalmology.** Glasgow Med. Jour., 1941, v. 136, Nov., pp. 127-134.

The author discusses the relationship of postgraduate study in ophthalmology to adult education in general, especially in regard to the future development of ophthalmic training in Glasgow. T. E. Sanders.

Silverberg, H. M. **Visual acuity in the indigent.** Arch. of Ophth., 1942, v. 27, Jan., pp. 161-162.

As a result of the analysis of 1,000 consecutive refractions on patients 18 years of age or older who were on home relief, it is concluded that visual acuity is a vital function and is not impaired by poor economic conditions. The percentage of cases with pathologic change was about the same as that found in private practice.

J. Hewitt Judd.

Stirling, A. W. **Random reminiscenses of last-century European oph-**

**thalmologists.** Arch. of Ophth., 1941, v. 26, Nov., pp. 727-741.

This article deals with personal experiences at the Royal Infirmary in Edinburgh, especially with Argyll Robertson, in Berlin with Schweigger, Schoeler and Hirschberg, and in England with Couper, Henderson, Morton, Lang, Hartridge, Maddox, Priestly Smith, Frost, Mules, Gunn, and Tweedie. The author speaks of associations in France with Landolt, Wecker, Galezowski, Panas, and Trousseau.

J. Hewitt Judd.

## 19

### ANATOMY, EMBRYOLOGY AND COMPARATIVE OPHTHALMOLOGY

Fortin, E. P. **Error of conception of Müller's fibers.** Arch. de Oft. de Buenos Aires, 1940, v. 15, July, p. 325.

According to the author, Cajal's conception of Müller's fibers is wrong, inasmuch as these so-called fibers represent actual canalizations of the retina through which the silver stain permeates, giving rise to the artifact described in classical treatises as fibers of Müller. (Photomicrographs.)

Plinio Montalván.

Loewenstein, Arnold. **Studies of the retina in bulk.** Arch. of Ophth., 1942, v. 27, Jan., pp. 73-90.

Examination of the unstained human retina in bulk cleared with potassium hydroxide and glycerin, and viewed with the binocular microscope with narrow iris diaphragm, shows many remarkable facts. The nerve-fiber bundles, which are bound together by fine, light-refracting glial cross fibers, appear raised by blood-containing vessels. The border planes between the inner and outer limbs of the bacillary layer show a clear distribution of rods and cones. In slides so prepared the yellow macular area keeps its color for months, and its capillary system is clearly visible. The vessel-free circular area measures 0.165 mm. A fingerprint design appears at the border between retina and pigment epithelium and is probably of importance as a structural support and for the nourishment of the neuroepithelial layer. It is thought to be the glial fibers of the outer limbs of the bacillary layer or the glial scaffolding between the neuroepithelial elements.

The retina in bulk from rabbits fed cholesterol for three to six months was stained with scarlet red and cleared with potassium hydroxide and glycerin. The vessel tree was sharply defined and the vascular end loops appeared much thicker than in human retinas. Cloudy deposits could be demonstrated around the hairpin-shaped end loops, which were explained as fatty compounds of the lymph stream leaving the blood vessels. A very narrow blood-filled meshwork at the surface layer of the kitten's retina is described as a membrana vasculosa retinae. In cases of hypertensive retinopathy in human beings a network of very thin capillaries is demonstrated, some of them with destruction of the walls and aneurysmatic widening. Fatty deposits of different shapes are demonstrated in different layers of the retina, some of them in a softened cleared-up area. Some tiny lipoid droplets at the retinal surface are too small to be recognized ophthalmoscopically. The thin capillary meshwork is assumed to belong partly to the reserve vessel system, which is usually empty.

J. Hewitt Judd.

Terry, T. L. **Extreme prematurity and fibroblastic overgrowth of persistent vascular sheath behind each crystalline lens.** Amer. Jour. Ophth., 1942, v. 25, Feb., pp. 203-204. (One color plate.)

Wald, G. **Visual systems of euryhaline fishes.** Jour. Gen. Physiology, 1941, v. 25, Nov. 20, pp. 235-245.

The retinas of the majority of marine fishes and all terrestrial vertebrates contain the rhodopsin system alone in which the photosensitive pigment, rhodopsin, is in a cycle with vitamin $A_1$. True fresh-water fishes have a different retinal cycle, compounded of the purple photo-pigment, porphyropsin, with vitamin $A_2$. In the present paper the author studies the systems of euryhaline fishes, which are those capable of existence in a wide range of salinities. He found that the visual system was commonly associated with the environment in which the fish spawned.

T. E. Sanders.

# PAN-AMERICAN NOTES

Edited by Dr. M. Uribe Troncoso

500 West End Avenue, New York

Communications should reach the Editor by the twelfth of the month

## Miscellaneous

*Pan-American Congress of Ophthalmology.* The president of the Local Committee in Uruguay, Prof. Vasquez Barrière, and a delegation attended a special session of the Argentinian Ophthalmological Society and extended a cordial invitation to the Argentinian ophthalmologists to participate in the Pan-American Congress in Montevideo. Prof. Vasquez Barrière will shortly be making a trip to Brazil and to Chile to extend a similar invitation.

The following countries have already elected their representatives to the Council: Argentina, Bolivia, Brazil, Canada, Chile, Costa Rica, Cuba, Dominican Republic, Ecuador, Guatemala, Mexico, Panama, Peru, Paraguay, Uruguay, United States, and Venezuela.

A Sight-Saving Committee has been organized by the Pan-American Congress of Ophthalmology under the presidency of Dr. F. Belgeri (792 Paraguay, Buenos Aires), the secretary being Dr. Baudilio Courtis (750 Parana, Buenos Aires).

The Committee for Trachoma is headed by the following physicians: Prof. Ivo Correa Meyer (727 Dr. Timotheo, Porto Alegre, Rio Grande do Sul, Brazil), president, and Drs. J. Sená of Argentina, Polk Richards and Phillips Thygeson of the United States, and J. Valdeavellano of Peru.

*Scholarships in the United States for Latin-American ophthalmologists.* Dr. Harry S. Gradle, president of the Pan-American Congress of Ophthalmology, has been successful in obtaining 24 scholarships, each in the amount of $1,000, for Latin-American ophthalmologists wishing to study in the United States. The choice of candidates for these scholarships will be made according to definite rules. The candidates will be chosen amongst those likely to make the best use of the scholarship. Contacts are being established with the various ophthalmologic centers in the United States for the allocation of the successful candidates.

*The Brazilian Board of Ophthalmology* (Conselho Nacional de Ophthalmologia) has been definitely established. According to its by-laws, all ophthalmologists who can prove that they have fulfilled certain requisites will be certificated until next June; after that certificates will be given only to those who have passed an examination. The first examination will be held in June, then regularly every year in that month. The requisites for admission to the examination are more or less those used in the United States.

The Executive Committee of the Brazilian Board of Ophthalmology is composed of Prof. Cesario de Andrade, president; Professor Linneu Silva, vice-president; Professor Paiva Gonçalves, secretary; and Prof. Paulo Pimentel, treasurer. Local committees are being formed in the most important ophthalmologic centers of Brazil.

*Latin-American postgraduate students at Columbia University.* The Dean of the School of Medicine of Columbia University reported for the year 1941 as follows: "The more concentrated postgraduate courses were attended by physicians from 43 States, 4 Territories and 20 Foreign Countries. Among this group there were 30 physicians from 13 Latin-American countries. The increased enrollment of Latin-American physicians is especially encouraging and indicative of the importance of the postgraduate program in promoting exchange of mutual interests among the Medical Profession of the Western Hemisphere." In the group of physicians mentioned there were several students of ophthalmology who stayed for several months.

*Guatemala.* A new society, The Lions, has been established in the country and is interested in the protection of the blind. The Guatemalan Girl Scouts have founded a school for the blind.

## Societies

*Argentina.* The next Argentinian Congress of Ophthalmology will take place in Cordoba in October, 1944.

*Brazil.* The next Brazilian Congress of Ophthalmology will take place in Bahia at the end of October, 1943. This will allow the participants to attend also the Pan-American Congress, which will take place in Montevideo at the beginning of November.

## Personals

The President of the Republic of Costa Rica has chosen Dr. Alexis Aguero delegate to the Council of the Pan-American Congress of Ophthalmology.

As a tribute to Professor Marquez on his seventieth birthday in March, the Mexican Ophthalmological Society held a special meet-

ing in his honor followed by a dinner attended by a large number of Mexican ophthalmologists and students of Professor Marquez in Mexico.

At a round-table conference of Latin-American students of Columbia University on March 11th, Dr. Jorge de Castro Barbaso, of the Municipal Health Department of Rio de Janeiro, asserted that doctors had done more than politicians and ambassadors to promote inter-American relations. However, he said, United States physicians too often neglect professional studies on their visits to South America, although they can learn much from their South American colleagues regarding tropical diseases, malaria, and syphilis.

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# NEWS ITEMS

Edited by DR. RALPH H. MILLER
803 Carew Tower, Cincinnati

News items should reach the editor by the twelfth of the month

## DEATHS

Dr. Raymond Robert Westover, Brooklyn, New York, died January 12, 1942, aged 58 years.

Dr. Isaac High Shelly, Norristown, Pennsylvania, died January 2, 1942, aged 55 years.

Dr. Max William Jacobs, St. Louis, Missouri, died January 9, 1942, aged 62 years.

Dr. Albert Stanley Freedman, Scranton, Pennsylvania, died November 15, 1941, aged 58 years.

Dr. Nathan Goodfriend, New York, New York, died January 17, 1942, aged 61 years.

Dr. Lincoln Jay Pierce, Brookfield, Missouri, died January 22, 1942, aged 56 years.

Dr. Joseph J. Shafer, Louisville, Kentucky, died January 4, 1942, aged 70 years.

Dr. Andrew Hunter, McKeesport, Pennsylvania, died January 23, 1942, aged 72 years.

Dr. Moses L. Haning, Browning, Missouri, died January 9, 1942, aged 63 years.

Dr. Robert Reid Berry, Union, South Carolina, died January 23, 1942, aged 64 years.

Dr. Leo J. Drozniakiewicz, Milwaukee, Wisconsin, died January 20, 1942, aged 60 years.

Dr. James Oscar Hicks, Victoria, Texas, died December 31, 1941, aged 61 years.

Dr. Ralph Livingston Daniels, New Bern, North Carolina, died February 21, 1942, aged 54 years.

Dr. Alexander Barclay, Sr., Coeur d'Alene, Idaho, died February 27, 1942, aged 59 years.

Dr. John Abraham Pratt, Minneapolis, Minnesota, died February 21, 1942, aged 73 years.

Dr. Charles H. Usher, Edinburgh, Scotland, died March 3, 1942.

## MISCELLANEOUS

The National Society for the Prevention of Blindness has instituted a campaign for protection of eyesight. Included in this are efforts to reduce the heavy toll of industrial eye accidents; a drive within the medical profession for earlier recognition of glaucoma; the training of nurses in eye health and sight conservation; demonstration of the value of social-service departments for eye patients in hospitals and clinics; promotion of sight-saving classes for the education of school children with seriously defective vision; and the maintenance of a clearing house of information for state-wide programs for prevention of blindness, whether under government or private auspices.

As part of its program of health education the Society sponsored 750 broadcasts by radio stations throughout the country, arranged for exhibits in 100 communities, distributed more than a quarter of a million pamphlets, and utilized various other channels for reaching the public, such as newspapers, magazines, motion pictures, and meetings.

The schedule of evening lectures for April and May as announced by the Manhattan Eye, Ear, and Throat Hospital for the resident staff and graduate students consisted of the following contributions: "Contact glasses" by Dr. E. Constantine; "Neuro-ophthalmology" by Dr. Louis Hubert; "Siderosis of the eye" by Dr. G. Bonaccolto; "Motor anomalies of the eyes" by Dr. Legrand H. Hardy; "Motor anomalies of the eyes—surgical correction" and "Principles of cataract surgery" by Dr. R. Townley Paton; "Ocular lesions in injuries of the head" by Dr. Frank C. Keil; "Office routine and etiquette in ophthalmic practice" and "Anesthesia in ophthalmology" by Dr. Guernsey Frey; "Ocular examination and visual requirements in the U. S. armed forces" by Dr. F. H. Theodore; "Neuro-ophthalmology" by Dr. Clarence Hare; "Dacryocystorhinostomy" by Dr. R. Castroviejo; "Wrong glasses from the right prescription" by Mr. A. Mangold; and "Macular degeneration" by Dr. Plinio Montalván.

The Department of Ophthalmology, The University, Glasgow, Scotland, announced that the following postgraduate lectures in ophthalmology were given: "Dark adaptation" by Professor Riddell; "Ophthalmic dermatology" by Dr. Herbert Brown; "Pathological problems" by Dr. James Hill; and "Vestibular nystagmus"

by Dr. Tom Howie. Although it was unlikely that any of their American colleagues would be able to attend this course of lectures because of existing circumstances it was interesting to learn that attempts were made to carry on such work during the war. The lectures were open to any medical members of the Allied Forces. Visitors are welcome in the department at any time.

### Societies

You are cordially invited to attend the thirteenth scientific meeting of the Association for Research in Ophthalmology, which will be held in Atlantic City on June 9, 1942, at the Marlborough-Blenheim. The following program has been arranged:

9:30 A.M.

A quantitative study of the cells and fibers in the nucleus-nerve complexes of the fourth and sixth cranial nerves. Robison D. Harley, M.D., Ph.D., Mayo Clinic, Rochester, Minnesota.

The intrascleral vascular plexus and its relations to the aqueous outflow. Manuel U. Troncoso, M.D., The Presbyterian Hospital, New York, New York.

Corneal permeability. I. Factors affecting penetration of drugs into the cornea. Kenneth C. Swan, M.D., and Norman G. White, M.S., State University of Iowa, Iowa City, Iowa.

Fibroblastic overgrowth of persistent tunica vasculosa lentis in infants born prematurely. III. Studies in development and involution of the hyaloid artery and tunica vasculosa lentis. T. L. Terry, M.D., Massachusetts Eye and Ear Infirmary, Boston, Massachusetts.

2:30 P.M.

Gonioscopic studies on the canal of Schlemm. Peter C. Kronfeld, M.D., H. Isabelle McGarry, M.D., and Homer E. Smith, M.D., The Illinois Eye and Ear Infirmary, Chicago, Illinois.

Some observations and experimental studies on the physiology of the ciliary muscle. Erich Sachs, M.D., Wayne University, College of Medicine, Detroit, Michigan.

Sulfadiazine iontophoresis in pyocyaneous infection of rabbit cornea. Ludwig von Sallmann, M.D., Department of Ophthalmology of the College of Physicians and Surgeons, Columbia University, New York, New York.

The aqueous veins: Physiologic importance of the visible elimination of the intraocular fluid. K. W. Ascher, M.D., University of Cincinnati, Ohio.

C. S. O'Brien, M.D.,
Secretary-Treasurer.

James H. Allen, M.D.,
Assistant Secretary-Treasurer.

The trustees are Algernon B. Reese, M.D., chairman, New York City; Frederick C. Cordes, M.D., San Francisco; Conrad Berens, M.D., New York City; Derrick Vail, M.D., Cincinnati; Sanford R. Gifford, M.D., Chicago; and Theodore L. Terry, M.D., Boston.

The meeting of the American Academy of Ophthalmology and Otolaryngology, to be held October 11th to 14th, has been changed from San Francisco as originally planned to Chicago. The convention period will consist of four days instead of the usual five.

The April 6th scientific session of the New York Society for Clinical Ophthalmology was devoted to a symposium on "Industrial ophthalmology in war effort" and consisted of the following papers: "Suggestions on first-aid in eye injuries—a measure of civilian defense" by Dr. Percy Fridenberg; "A more realistic ophthalmic service in industry" by Dr. Albert C. Snell, discussion opened by Dr. Elbert S. Sherman; "The problem of faulty stereopsis in industry" by Dr. Laurance D. Redway, discussion opened by Dr. Morris Davidson; "Industrial ophthalmology from the standpoint of industrial hygiene" by Leonard Greenburg, Director of Industrial Hygiene, New York State Department of Labor, discussion opened by Mrs. Eleanor Brown Merrill, National Society for the Prevention of Blindness.

### Personals

At the ninety-sixth annual session of the Ohio State Medical Association Dr. Alson E. Braley, New York, presented a paper on "Sulfonamides in the treatment of ocular infections."

Among the guest speakers at the fiftieth annual session of the Oklahoma State Medical Association was Dr. Algernon B. Reese, New York, who spoke on "Exophthalmos associated with thyroid disease."

The Howe Lecture of Ophthalmology, given under the auspices of the Howe Laboratory of Ophthalmology at Harvard, was presented by Marion Hines, Ph.D., associate professor of anatomy at Johns Hopkins University School of Medicine. The title of his lecture was "Recent contribution to the localization of vision within the central nervous system."

Drs. Frank E. Burch and Edward P. Burch announce the association of Dr. Ferdinand L. P. Koch with them in the practice of ophthalmology at 424 Hamm Building, St. Paul, Minnesota.